DOCUMENT RESUME

ED 210 171 SE 035 855

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TITLE Water: A Vital Resource. Environmental Education Supplementary Instructional Guide. Sixth Grade Level.
INSTITUTION Hawaii State Dept. of Education, Honolulu. Office of Instructional Services.
REPORT NO RS-81-1095
PUB DATE Jun 81
NOTE 232p.

EDRS PRICE MF01/PC10 Plus Postage.
DESCRIPTORS *Conservation Education; *Elementary School Science; Environmental Education; Grade 6; Instructional Materials; *Interdisciplinary Approach; Intermediate Grades; Learning Activities; *Science Activities; Science Education; Teaching Guides; *Water Resources

ABSTRACT

Water related activities for sixth-grade students are presented as one possible way to incorporate environmental education into the existing curriculum of Hawaii schools. Designed as an interdisciplinary approach, the activities integrate numerous thematic and subject areas to teach that fresh water is a limited but vital natural resource. Topics include water in nature, use and control, distribution, purification, issues, and alternatives and consequences. Lessons are self-explanatory, allowing for independent student work. They involve a wide range of activities including experimentation, creative writing, interviewing, oral reports, field trips, art work, map work, research, and simulations. Each of the seven sections contains a list of instructional goals, objectives with an indication of subject area taught, performance expectations, essential competencies, and section objectives as well as the activities and teacher digest of the activity. A summary chart for the sections indicate the subject areas, teaching approach, resources, and time requirements for each lesson. (DC)

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WATER
A VITAL RESOURCE

ENVIRONMENTAL EDUCATION SUPPLEMENTARY INSTRUCTIONAL GUIDE

SIXTH GRADE LEVEL

OFFICE OF INSTRUCTIONAL SERVICES/GENERAL EDUCATION BRANCH • DEPARTMENT OF EDUCATION • STATE OF HAWAII
RS 81-1095 • JUNE 1981

SE 035 855

The Honorable George R. Ariyoshi
Governor, State of Hawaii

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FOREWORD

Fresh water is a basic and critical resource not only for human survival but for survival and growth of all plants and animals. It is important biologically, aesthetically, ecologically, economically, politically, vocationally, and geologically. In Hawaii and elsewhere adequate water sources and treatment and delivery systems are necessary to meet domestic needs and facilitate economic development particularly in the agricultural sector. While water is a renewable resource, there are definite physical and financial contraints on this renewability. Readily available water sources are limited and other sources costly to develop.

In recent years there has been growing awareness that on Oahu easily developable groundwater supplies are diminishing and on the neighbor Islands new water sources and transmission facilities need to be developed. In addition, certain rural areas in Hawaii are not being provided with water that meets national water quality standards. It is vitally important therefore that Hawaii's citizens understand and appreciate the nature and limitations of Hawaii's fresh water resource to insure that this resource is conserved and managed in the most effective manner to meet human needs and maintain a quality environment. As future citizens, Hawaii's youth must be prepared to make many critical decisions concerning this resource with an in-depth understanding of the consequences of those decisions.

This instructional guide has been designed to help teachers develop students' awareness and understanding of this most vital resource--fresh water and the skills, attitudes, and values to make wise decisions concerning development and use of this resource. Activities in this guide integrate many subject areas to investigate the various aspects of water ranging from the beauty of moving water, and quality of water to societal use and control of water. The unit also highlights the difficulty in resolving environmental issues and emphasizes the need for conservation and proper management of this precious resource.

Charles G. Clark, Superintendent

ACKNOWLEDGMENTS

The original draft of this guide was developed in 1978 under a grant from the Office of Environmental Education, Department of Health, Education, and Welfare. The grant proposal requested funding to "develop a model for integrating environmental education in the existing elementary curricula". Project staff included personnel from Curriculum Research and Development Group, University of Hawaii and Department of Education. The generous evaluations of that original draft and cooperative efforts of a large number of people, including State and District Educational Specialists, administrators, teachers, University of Hawaii personnel, and community members have resulted in revision of the original draft and creation of this guide.

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Appreciation is also extended to the Committee for Environmental Education for the review of the various stages of the project.

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Table of Contents

Foreword	i
Acknowledgments	ii
Table of Contents	v
Introduction to the Unit	A1
Organization of the Guide	AJ
Unit Outline	A2
Section I -- Water in Nature	B1
Section 2 -- Use and Control	C1
Section 3 -- Distribution	D1
Section 4 -- Purification	E1
Section 5 -- Water Issues	F1
Section 6 -- Alternatives and Consequences	G1
Section 7 -- Projects and Follow-up	H1
Bibliography	H17
Appendix	I1
Agencies and Organizations Concerned with Water Resource and Protection	I2
Annotated list of Journals and Magazines	I10
Annotated List of Newletters, Bulletins, and Papers	I12
Audiovisual Materials	I13
Abbreviations Used in this Guide	I16

INTRODUCTION

The purpose of this guide is to provide teachers with a means of integrating the numerous thematic and subject areas that they are required to teach to develop students' awareness and understanding of a vital resource--fresh water. Furthermore the guide is designed to help students develop the skills, attitudes, and values to make wise decisions concerning development and use of this precious resource.

Unit Objectives

1. Develop an awareness of the importance of water and the way in which it affects everyone's life.

2. Develop an understanding of Hawaii's unique water system.

3. Identify water use and regulation as an important and continuing environmental issue.

4. Develop skills to cope with environmental issues including researching information, objective consideration of alternatives, and rational decision making.

5. Develop communication skills and creative expression through oral and written reporting, graphic display, art and music.

6. Develop an appreciation for beauty and aesthetics in the environment.

ORGANIZATION OF THE GUIDE

This guide was designed as one possible approach for the integration of environmental education into the existing curriculum. Activities in the guide involve investigation of various aspects of water ranging from the quality of water to the societal use and control of water. The main emphasis of the unit is that water is a limited but vital natural resource. Alternatives and the need for wise decision making regarding water use are stressed.

Each section of the guide includes the instructional goals and objectives and performance expectations from the Environmental Education K-12 Curriculum Guide, essential competencies, section objectives, student activities and teacher digests with background notes.

The student activities are self-explanatory and allow students to proceed independently, with only minimal teacher assistance.

The teacher digest for each lesson provides a synopsis of the student activity. Each digest is divided into three sections: Preparation, Student Activities, and Summary. Teacher Notes are included whenever supplementary background information would be helpful.

The appendix of the guide contains information on supplemental resources which relate to water.

UNIT OUTLINE

Lessons	Thematic and Subject Areas	Approach	Resources	Approximate Time
Section 1 - Water in Nature	Sc, Art, SS, HA N, LA, LS, M			
1.1 Watch the working		Oral reporting, Discussion, Visual representation	SCIS, STEM	1 Hour
1.2 Cycles		Oral reporting, Discussion, Visual representation	SCIS, STEM	1-2 Hour
1.3 The water cycle		Research, Visual representation	SCIS, STEM, GINN	1 Hour
1.4 Evaporation		Experimentation, Oral and written reporting, Discussion, Visual representation	GINN, STEM,	30 minutes
1.5 Condensation		Experimentation, Discussion	STEM, FAST, SCIS, Lab-household supplies	30 minutes
1.6 Leaky leaves		Experimentation, Visual representation, Discussion	STEM, FAST, SCIS, Lab-household	Experiment extends 1-3 days, not much class time
1.7 Will it rain today?		Observation, Discussion Visual representation, Game		1 Hour

Lessons	Thematic and Subject Areas	Approach	Resources	Approximate Time
1.8 Water after the rain		Matching, Discussion		30-45 minutes
1.9 Oahu's water supply		Observation, Discussion, Reading, Visual representation	WATER SUPPLY-From Exploring Nature in Hawaii, Book V	1-2 Hours
1.10 Watch how it happens		Observation, Discussion, Group presentation	Videotape - "Water - Man's Greatest Need"	1 Hour
Section 2. - Use and Control	Sc, SS, N, H, Art, C, LA, M			
2.1 Water is essential for survival		Discussion, Visual representation, Oral reporting	WATER POLLUTION - Addison Wesley, GINN STEM	15-30 minutes
2.2 Water, our 2nd most vital resource		Observation, Visual representation, Discussion	WATER POLLUTION - Addison Wesley, GINN, MAPS	30-minutes class, then good home assignment, 2-3 days
2.3 150 gallons a day?		Oral reporting, Visual reporting, Survey, Research, Observation	WATER POLLUTION - Addison Wesley, GINN MAPS	2 Hours some home time
2.4 Water use at your school		Observation, Visual representation	MAPS	1-2 Hours
2.5 Who controls the water?		Discussion, Observation, Visual representation, Interview, Research	Videotape: "Water - Man's Greatest Need"	1-3 Hours

Lessons	Thematic and Subject Areas	Approach	Resources	Approximate Time
Section 3. - Distribution	Sc, SS, H, M, Art, HS, C, V			
3.1 Our water supply		Reporting, Writing, Committee	WATER SUPPLY-publication, Reference material from Board of Water Supply	2-3 Hours
3.2 From source to sink		Committee, Guest speaker, Model building	Blueprint of water mains, Engineer from Board of Water Supply	2-3 Hours
3.3 How does the water get to school?		Field Trip, Committee	School custodian, School map	1-2 Hours
3.4 How is water used in the school? How much does it cost?		Committee	School map, School water bills (transparency)	1-2 Hours
3.5 Waste water system or Where is "Down the Drain?"		Committee	Diagrams from Board of Water Supply	1-2 Hours
Section 4. - Water Purification	Sc, SS, H, N, LA, M			
4.1 Getting water pure again		Inventory, Oral reporting, Experiment	Lab and Household supplies, MAPS, STEM	2 Hours
4.2 Speeding up the process		Reading, Lecture, Research	Transparencies, Dept. of Public Works slide/tape presentation	1-2 Hours
4.3 Water from the sea		Discussion, Demonstration, Experimentation, Creative writing	Dept. of Public Works lab supplies	1 Hour

Lessons	Thematic and Subject Areas	Approach	Resources	Approximate Time
4.4 Getting the information straight		Field trip	Depat. of Public Works	2-3 Hours
4.5 The person from sewers		Guest speaker	Dept. Of Public Works	1 Hour
Section 5. - Water Issues	Sc, SS, H, HS, LS, N, C, Music, Art, V, M			
5.1 Is there a problem?		Reading, Discussion Creative writing, Oral reporting	Newspapers, Science & social studies texts	1 Hour then another hour following day
5.2 Where does it rain?		Reading, Map work, Discussion, Oral reporting	Encyclopedia-resource books, Exploring 1978 (summer enrichment University Lab School)	1-2 Hours plus homework time
5.3 Too many people?		Map and Atlas reading, Reading, Creative writing	Current census reports, World Atlas, STEM	1 Hour
5.4 Water: A case of Supply/Demand		Discussion, Oral reporting	Concepts & Values, Economic principles Resources	15-45 Minutes
5.5 Is there a solution to pollution?		Discussion, Oral reporting, Reading, Visual representation	SCIS, Water Pollution-Addison Wesley	1-2 Hours

Lessons	Thematic and Subject Areas	Approach	Resources	Approximate Time
Section 6.- Alternatives and Consequences	Sc, SS, H, N. C, LA			
6.1 The controversy		Audio-visual, Discussion	Videotape - "Water - Man's Greatest Resource"	1 Hour
6.2. Water regulations: What alternatives?		Reading, Creative writing, Simulation	Student Activities 6.2a to 6.2h	Preparation: 1 Hour Mock Senate Hearing: 30 minutes - 1 Hour Summary: 20-30 minut possibly 2-3 days involved
Section 7. - Projects and Follow-up	Sc, LA, N, H, HS, LS, C, Art, Music, PE, V			
7.1 Water-Is our supply running out?		Reading, Research, Survey	NEED - Adventure in Environment	1 week
7.2 Can you hear a scene?		Listening, Discussion, Creative exploration	NEED - Adventure in Environment, recording- of "The Moldau", "The Fountains of Rome", "Callings" or "Grand Canyon Suite".	45-60 minutes
7.3 The voices of water		Listening, Discussion, Creative exploration	Tape recorder and audiotapes	45 minutes

SECTION 1
WATER IN NATURE

Instructional Goals

Students will demonstrate an appreciation for the interdependence of living things in the closed earth system.

When faced with decisions concerning the use of terrestrial and extraterrestrial resources, students will select practices developed in recognition of present and future environmental and human needs.

Students will voluntarily participate in programs involving resource reclamation.

Instructional Objectives

Give examples of people preserving or destroying the earth's life support systems. Sc, H, SS

Demonstrate how people are a part of the ecosystem and must live within it. Sc, SS, H

Formulate a model to illustrate the finite nature of the earth system. Sc, SS, H

Discuss the concept that the earth is a spaceship with limited resources and has a limited capacity for recycling. Sc, SS, H, N

Develop a model to demonstrate how water can be recycled. Sc, SS, H

Write an imaginative story about a drop of water's journey through the water cycle. Sc, LA, H

Collect data on the percentage of the world's oxygen supply provided by the oceans and identify the key organisms in this cycle. Sc, LS

Identify items used which may be recycled. Sc, SS

Name resources which are used and classify those which are renewable and those upon which people are dependent for basic needs. Sc, SS, N

Identify problems involving soil, water, air and plant life in the community and suggest and defend possible solutions to the problems. Sc, SS, H, N

Compute the volume of water falling on a specified area during a one-inch rainfall. M

Performance Expectations

Discusses attitudes which contribute toward living in harmony with the environment.

Identifies causes of local environmental problems.

Identifies and describes environmental factors which influence the beliefs of different cultures.

Conducts simple investigations to gain first hand information on environmental matters.

Communicates feelings evoked by various types of environments.

Identifies instruments or methods that can be used to gain information about environments or to change an environment for a desired result.

Essential Competencies

Use computational skills in situations common to everyday life.

Read and use scales on standard measuring devices.

Reach reasoned solutions to commonly encountered problems.

Use resources for independent learning.

Demonstrate knowledge of important citizen rights and responsibilities.

Section Objectives

Identify the various systems found in everyday life.

Describe the function of a system and define the different kinds, including open, closed, visible, invisible.

Define a cycle and relate that definition to familiar processes.

Identify and describe the basic processes involved in the water cycle including evaporation, condensation, transpiration, precipitation.

Develop investigation and experimentation skills.

Develop mathematical skills such as computation and measurement and relate these skills to problem solving methods.

Understand the unique charcteristics of Oahu's water supply.

Graph and visually represent statistical evidence.

Identify several common sources of water vapor in the atmosphere.

Communicate findings acquired through research.

Develop an awareness of the relatively small quantity of fresh water on earth.

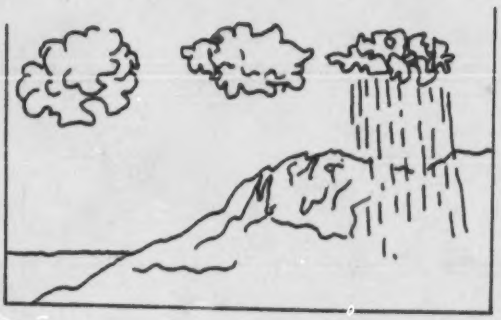
Distinguish between surface and ground water.

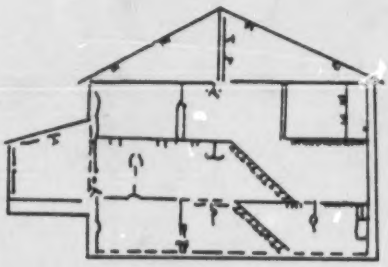
Use art as a means of communication.

Use maps as a source of information.

Relate general knowledge about the water cycle to the processes as they occur on Oahu.

Make predictions based on acquired facts.





WATCHING THE WORKINGS

I. QUESTIONS

What do these pictures have in common?

How are a body, a house and an environment similar?

II. DISCUSSION

Complex things such as a house, a body, an environment are made up of numerous smaller parts. Each part has a function, a job to do to make the structure work. Sometimes many parts work together and have a larger function than each one had individually. When this happens, all the parts together are called a system.

Systems may be visible or invisible. If all the parts of a system are visible it is easier to study them and observe the interactions. However, if you cannot see, hear, feel or taste the objects in a system, you must be alert for other clues or evidence of interactions. Systems can vary in other ways. They may be open or closed depending on whether or not the necessary parts are used up after a time and must be replaced for the system to continue (open), or if they are always present as part of a continual process, with nothing added in or taken out (closed).

THINGS TO DO

1. Now tell about each of the systems pictured on the previous page. What is the system?

2. Draw a picture of a system that you can find outside your classroom, in your bedroom, at home or at your favorite free time place.

3. Think of 10 different systems. List them and tell whether they're open or closed.

ADDITIONAL ACTIVITIES

1. Study your aquarium/terrarium. Make a chart that shows the systems you found there.

2. Map a system you cannot see.

HOW TO TELL ABOUT IT

With a group of 3-4 other classmates, discuss what you have learned about systems. Share the picture you drew in #2 of Things to Do.

WATCHING THE WORKINGS
DIGEST

I. PREPARATION

None required.

VOCABULARY

system
interaction

II. STUDENT ACTIVITIES

Problem: What do these pictures have in common?

How are a body, a house and an environment similar?

1. Students will discuss each pictured system and define system.
2. Students will illustrate a system.
3. Students will list 10 systems and classify them as open or closed.

III. SUMMARY

As a class or in small groups, students should identify the illustrated systems (circulatory, hydrologic, electrical). Additional examples of systems might include:

spaceship
transit system
digestive, nervous systems
educational system
auto's electrical, fuel systems
ecosystem

In small groups, students might share their illustrated systems. SCIS provides extensive background and experience with systems, subsystems, and ecosystems.

Cycles

I. Activity

Take a drink. Could it be that you are using some water once used by a dinosaur? By Captain Cook? By yourself when you were younger?

II. Discussion

Strange as it may seem at first, this is possible because water moves in a cycle. A cycle is a process that occurs over and over again. It is like a circle. It is difficult to pick out a beginning or an end; the process continues in the same order no matter where it starts. There are many cycles we are familiar with already. The idea of the earth's water cycle is one of these. We know that water moves through this cycle over and over again and that it never really leaves the earth. This cycle existed long before life ever appeared on land. We believe it operated then as it does today.

Questions to Ask

1. Look again at the beginning questions. How would you answer these?
2. Can cycles be broken?
3. What does "recycle" mean? Give an example.

How to Tell About It

Think about whether or not you believe cycles can be broken. Prepare an answer with examples to support it. Find a partner, possibly someone with whom you disagree. Discuss your answers with each other and compare what evidence you have found.

ADDITIONAL ACTIVITIES

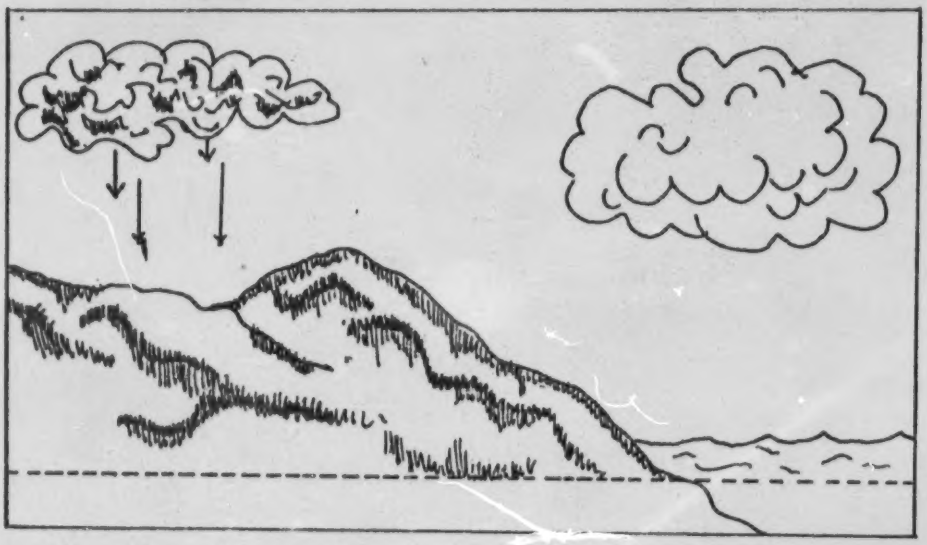
1) Choose a number from 2 through 6 and create a math cycle. Take your number through addition, subtraction, multiplication and division. See if you can end with the same number as when you started.

Example - choose 8
Add - 4
Subtract - 6
Multiply - 4
Divide by - 3
Answer 8!

2) Write a story. Imagine you are a drop of water. Tell where you have been, where you are now, where you are going. Be creative!

SUMMING IT UP

Below is a sketch of an environment. The arrows represent parts of the water cycle. Draw other arrows going to or from the symbols to show how water flows through this environment. You may add more symbols if you wish.



CYCLES
DIGEST

I. PREPARATION

None required. For added effect small paper cups containing water could be distributed to each student.

VOCABULARY

cycles
recycle

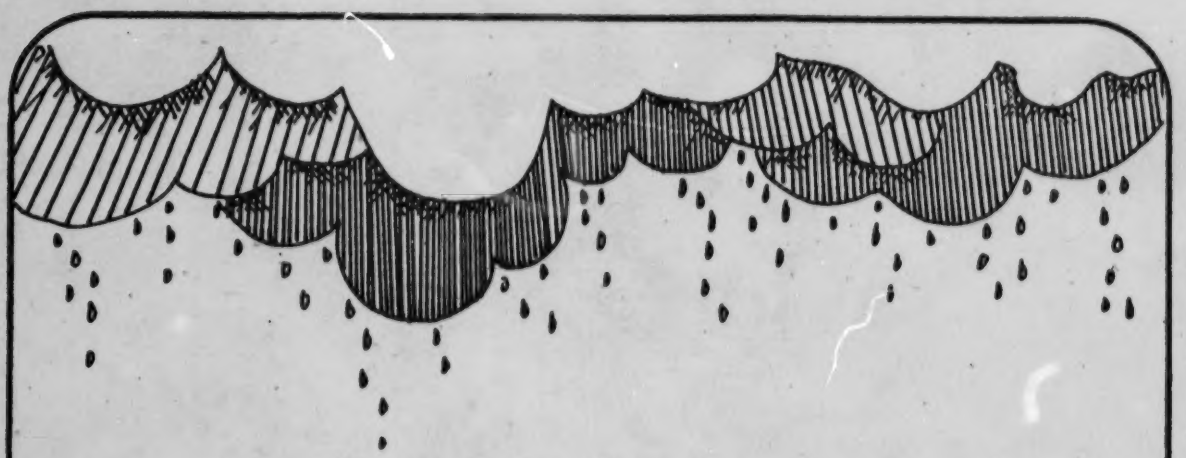
II. STUDENT ACTIVITIES

Activity: Take a drink. Could it be that you are using some water once used by a dinosaur? By Captain Cook? By yourself when you were younger?

1. Discuss the questions above.
2. Decide whether or not cycles can be broken.
3. Define recycle and give an example.
4. Defend and support answers for #2 - whether or not cycles can be broken.

III. SUMMARY

The student is asked to draw arrows on a sketch to represent the water cycle. This is intended to be an evaluation exercise and is designed to provide data on the students' present understanding of the water cycle. Based on this information, you can decide which of the following student activities need to be covered. If a student seems to have an understanding of each of the components, s/he may skip the activities relating to each component individually, i.e. Evaporation, Condensation, Leaky Leaves, and proceed to activity 1.7 for a summary of the water cycle.



THE WATER CYCLE

I. QUESTIONS

Most of us have enjoyed playing and being in the rain. We have watched clouds and have seen rainbows. We've seen the rain fall down. But how can it ALWAYS go down? How does the water get back up?

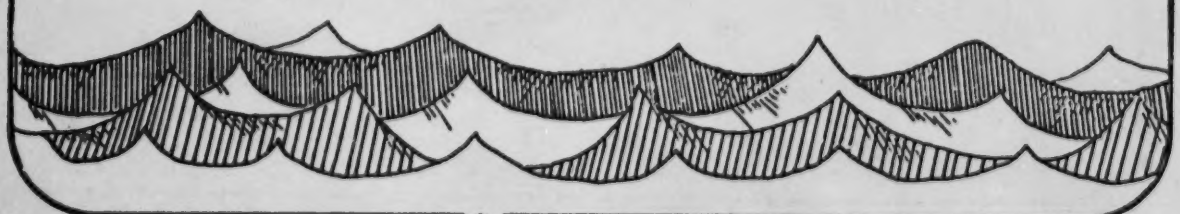
II. DISCUSSION

Wherever you look in an environment, there is water in one form or another. There is water...in the air, on the ground, in the ground. The amount of water never changes. As water goes from the oceans and lakes, into the air, and back to the earth again, it changes only in form. This changing of forms is called the water cycle and is going on all around us, all the time.

Water evaporates from the ocean, then moves as clouds over the land. The water vapor condenses in the cool upper air as rain or snow where it falls on the land. The water may run into streams, may percolate through (soak into) the ground, and be stored as ground water, or be absorbed by plants to be later transpired through the leaves. Eventually, rivers carry much of the water back to the ocean.

WHAT TO DO

With a group of 4-5 students and several old magazines construct a water cycle collage.



WHAT YOU'LL NEED

old magazines, newspapers
scissors
glue
a large sheet of paper, cardboard or posterboard

HOW TO DO IT

Find or make pictures to represent each part of the water cycle. Put them all together into one collage to show how they interact to make a water cycle. You may include words in your collage if you wish.

ADDITIONAL ACTIVITIES

1. Look at a rainfall map of the world. Pick 2 locations and compare their rainfall. Do areas near oceans seem to have greater rainfall? Why or why not? Where are the wettest/driest places on our earth?
2. Using reference books find out (1) what percentage of the earth is covered by water? (2) what percentage of the world's water is fresh? (3) what percentage is salt water? Now represent the percentages you have found on a pie graph or another type of graph or table. You may want to look for examples of graphing in your math, social studies or science books for ideas.

QUESTION TO THINK ABOUT

Why is salt water much less useful to human beings than fresh water?

THE WATER CYCLE
DIGEST

I. PREPARATION

The following materials should be available for student use:

- old magazines
- scissors
- glue
- large sheets of paper or posterboard
- atlas
- reference books

VOCABULARY

water cycle
evaporate
condense
percolate
transpire

II. STUDENT ACTIVITIES

Question: How does the water get back up?

1. Students will construct a water cycle collage.

III. SUMMARY

Even though most of the Earth's surface is covered by water, only a very small portion is suitable for most uses.

"Excess body salt is eliminated through perspiration and urine (however, there is less than 1/2 as much salt in perspiration or urine as there is in ocean water). If only seawater were available to drink, the body wouldn't be able to get rid of excess salt amd death would eventually result. Actually, drinking salt water usually causes vomiting and probably a person would die of thirst." (Ginn 6) Also excessive salt water usually kills plants.

The Water Cycle

Notes

1. Students will need an atlas or reference books showing rainfall maps. They will compare locations of the wettest and driest places on earth.

   Some of the Earth's wettest places are:

Mount Waialeale, Hawaii	460" per year
Quibdo, Columbia, South America	422" per year
Cherrapunji, India	450" per year
Debundocha, Cameroon, Africa	405" per year
Henderson Lake, B.C., North America	262" per year

   Some of the Earth's driest places are:

Puako, Hawaii	9.00" per year
Arica, Chile, South America	0.02" per year
Furnace Creek, Death Valley, California	2.00" per year
Wadi Halfa, Sudan, Africa	0.10" per year
Al Karijah, Egypt, Africa	0.00" per year

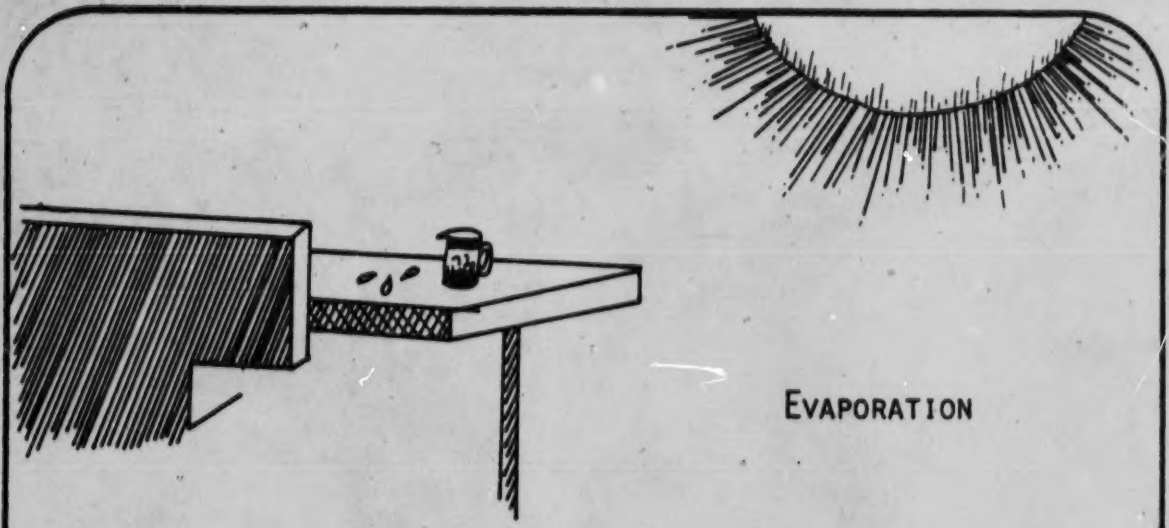
2. Students will use reference books to find the following statistics:

   a. what percentage of the Earth is covered by water? (71%)

   b. what percentage of the world's water is fresh? (3%)

   c. what percentage is salt water? (97%)

   Students will construct a graph or table using these figures.



EVAPORATION

I. QUESTION

If you spill a drop of water on your desk, what do you think will happen to it if you let it sit for 5 or 10 minutes?

II. DISCUSSION

You remember that water can be found everywhere on our planet and that the amount never really changes, only the form. This means then that the water in such places as oceans, lakes, and ponds is actually the same water found in clouds. There has to be some way for the water to get from one form to another, for the ocean water to "get up there". The process that causes water to move from an ocean to a cloud is called <u>evaporation</u>.

WHAT TO DO

1. Place a drop of water on your desk. Try not to disturb the drop, How does it look after 5 minutes? after 10 minutes? How long does it take before the drop is gone? Compare your time with that of a classmate. If his or her answer was different, give possible reasons why.
2. Place several lids containing water in different locations around your classroom. Watch to see which lid's water evaporates first, next, etc.
3. Suppose that on a very humid day, you were trying to dry out a wet pair of sneakers. If you put the sneakers outside your door, would you expect them to dry out quickly or slowly? Explain your answer in writing or orally.

QUESTIONS TO ASK

- Does water evaporate at different speeds?
- What factors affect the rate of speed for evaporating?
- How can you relate these factors to the evaporation that takes place in nature?

HOW TO TELL ABOUT IT

Compare the answers you arrived at after doing the activities and questions with those of the others in your class. Find a way to share this information, either through drawings, tables, charts, presentations, discussion or another method of your own choosing.

ADDITIONAL ACTIVITY

Most of the water vapor in the air comes from evaporation from the oceans. A tremendous amount of water vapor enters the air from this large wet surface. Find out how long it takes a layer of water 1 cm deep to evaporate from a cake pan. That much water weighs about a pound. But...the area of the ocean is about 10,000,000,000,000,000 times as big as a cake pan. In the same time it took for the water to evaporate from the pan, how many pounds of water evaporated from the ocean?

EVAPORATION

DIGEST

I. PREPARATION

The following materials should be available for student use:
water
lids - any size or type
cake pan
cm stick

VOCABULARY

evaporation
humid

II. STUDENT ACTIVITIES

Activity: Spill a drop of water on a desk, let it sit for 5-10 minutes. What will happen?

A. Place several lids of water in different locations around the classroom. See which lid's water evaporates first, next, etc.
B. If you put a pair of sneakers outside on a humid day, would you expect them to dry out quickly or slowly? Explain orally or in writing.

If you are using SCIS in your science program, much of this material is covered in Part Two, The Water Cycle. You may elect to do the activities described in that chapter, or may review the essential concepts if your class has completed this section already.

III. SUMMARY

The following questions may be answered by discussion or written assignment:
- Does water evaporate at different speeds?
- What factors affect the role of speed for evaporation?
- Now can you relate these factors to the evaporation that takes place in nature?

Follow these with a group comparison/sharing time, then students present it through drawings, tables, charts, discussion or another method of their choice.

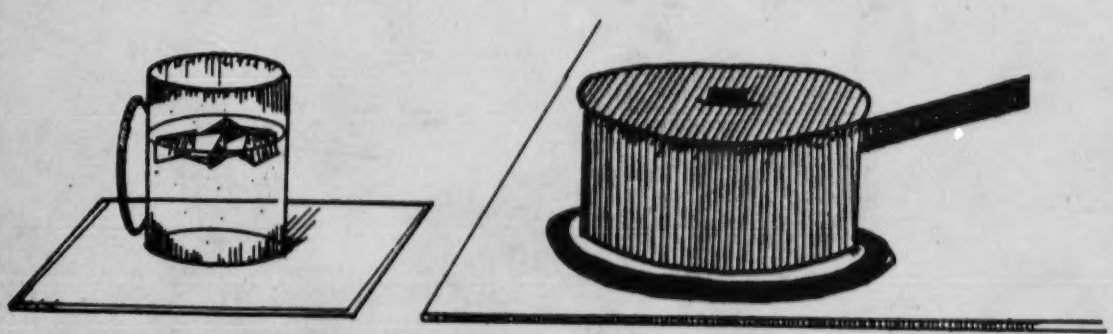
CONDENSATION

I. OBSERVATION

What happens to the outside of this glass that your teacher has filled with ice and water? What happens to the area where the glass is setting?

II. DISCUSSION

There is water vapor in the air all around you. On some days there is more water vapor in the air than on other days. Do you notice some days when the air feels especially moist even though it isn't raining? Most of the time we cannot see this water vapor even though it is there. But under certain conditions the water vapor condenses (changes from a gas or vapor to a liquid) and we can see it as small drops of water. This is what you observed happening on the outside of the glass of ice and water. Condensation occurs when the warm water vapor in the air comes into contact with a cool surface. In the water cycle this occurs when the water vapor in the clouds condenses in the cool upper air and falls as rain or snow.



QUESTIONS TO ASK

Why are there drops of water on the inside of a lid that has been covering cooking food? When your family goes riding during a rain, what happens to the inside surfaces of the closed car windows?

How cold does an object have to be for moisture to condense on it?

SOMETHING TO DO

To determine how cold an object must be for moisture to condense on it, do the following experiment.

What you'll need: an empty shiny can
water
small pieces of ice
thermometer
spoon or stick

How to do it: Fill a shiny can about half full of water. Be watching for the first sign of condensation. Add a small piece of ice and stir gently with the spoon until the ice has melted. Continue with small pieces of ice until the first sign of condensation on the can appears. Record the temperature! This temperature is the dew point - the temperature at which water vapor begins to condense. Dew is one example of condensation.

* Note: Do not stir with the thermometer.

CONDENSATION
DIGEST

I. PREPARATION

The following materials are needed:
- a glass
- an empty shiny can
- water
- small pieces of ice
- thermometer
- spoon or stick

VOCABULARY

condense
water vapor
dew point

II. STUDENT ACTIVITIES

Activity: Determine how cold an object must be for moisture to condense on it.

Fill a glass with ice and water and ask students to note what happens to the outside of the glass and to the area where the glass was setting for a few minutes.

This experiment follows several questions for the students to think about, then answer orally in discussion or in writing as part of summary activity.

If you are using SCIS in your science program, much of this material is covered in Part Two, The Water Cycle. You may elect to do the activities described in that chapter, or may review the essential concepts if your class has completed this section already.

III. SUMMARY

Answer the following questions orally or in writing:
1. Why are there drops of water on the inside of a lid that has covered cooking food?
2. When your family goes riding during a rain, what happens to the inside surfaces of the closed car windows?
3. How cold does an object have to be for moisture to condense on it?

I. QUESTIONS

What happens to all the water that plants absorb? Do they perspire? Are the leaves of plants sources of water vapor? How much water does a plant lose through its leaves?

II. DISCUSSION

About 90 percent of the weight of the living tissues of most plants is water. Transpiration is the loss of water vapor by a plant. Water taken in by the roots flows up into the leaves and evaporates. It is given off to the air as water vapor.

WHAT TO DO

To answer the beginning questions, do the activities below.

1) Are the leaves of plants sources of water vapor?

What you'll need: 2 potted geranium plants
2 plastic bags
2 twistees or twine

How to do it: Remove all the leaves from one of the plants. Do not remove any leaves from the other. Then pull a plastic bag over each plant. Tie the bags firmly around the stems near the soil. Put the two plants where they will get light, but not direct sunlight. After several hours, examine the plastic bags. How do they differ? How do the plants themselves differ? What might have caused the conditions inside the bags? Have you seen similar conditions inside a terrarium? (STEM-6)

2) How much water does a plant lose through its leaves?

Devise an experiment so that you weigh a plant each day to figure out how much water is being lost. Some of the water loss might be from soil in the pot so you might also set up a pot of soil without any plant. Remember to weigh any water you add to the pots. Record your results on a chart or graph.

ADDITIONAL THINGS TO THINK ABOUT

1. A tremendous amount of water evaporates from the leaves of green plants. About 50 gallons of water can enter the air each day from a large tree. How many trees are there on your school ground? How many gallons of water vapor might they supply to the air? Think of how much water vapor would come from a large forest in a day!

2. On a walk from the mountains through a forest to the sea you may notice differences in both the scenery and the weather. What might some of these changes be? Where would you be most likely to see fog or feel damp?

LEAKY LEAVES

DIGEST

I. PREPARATION

Each group or individual should have the following:

2 potted geranium plants
2 plastic bags
2 twistees or twine

VOCABULARY

transpiration

II. STUDENT ACTIVITIES

Question: What happens to all the water that plants absorb?

Conduct two experiments: the first designed to find out if the leaves of plants are sources of water vapor; the second to find out how much water a plant loses through its leaves.

In doing this activity, be sure the following points are brought out: 1) Soil in the pot without a plant should be watered the same as soil in which a plant is growing. 2) Both pots should contain the same kind of soil. 3) Both pots should be kept in the same place.

III. SUMMARY

Explain and give support for answers to the above questions. A chart like the following could be used to record results in activity 2.

date	sunny or cloudy	pot with soil and plant		pot with soil		water lost by plant
		weight	water lost by plant and soil	weight	water lost by soil	

WILL IT RAIN TODAY?

I. ACTIVITY

Above is a sketch representing Oahu. Think about the water cycle. Everything needed to complete the water cycle is evident on Oahu. Find those necessary things in the sketch above and label them.

II. DISCUSSION

In many places the things necessary for the water cycle and all the various stages of the cycle occur too far away for students to be able to visualize all the components at once. You are lucky! You can probably see all the components of the water cycle by simply going outside and looking around you.

QUESTIONS OF ASK

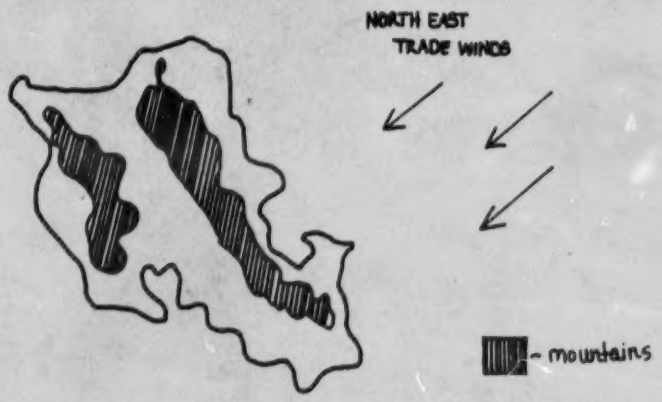
Are there clouds in the sky? Where did these clouds come from? Where are the clouds? Does rain often occur there? In what direction does the wind usually blow? Which side of our island receives the most rain?

WHAT TO DO

Each of the things you labeled in the sketch contributes to the water cycle. Complete the chart below:

Necessary condition	What process happens

SUMMING IT UP



Using what you know about the water cycle, predict what you think the rainfall pattern on Oahu might be. Which areas will receive the most/least rain? Why?

ADDITIONAL ACTIVITIES

Play the game "Home Before It Rains".

WILL IT RAIN TODAY?

DIGEST

I. PREPARATION

No preparation necessary.

VOCABULARY

component
visualize
water vapor
predict

II. STUDENT ACTIVITIES

Activity: Find the water cycle components in the sketch and label them.

1. Students will label components of a water cycle as seen in the task card sketch.
2. Students will construct a chart showing what process occurs when certain conditions are present.
3. Students will predict rainfall pattern for Oahu.
4. Students will play the game "Home Before it Rains".

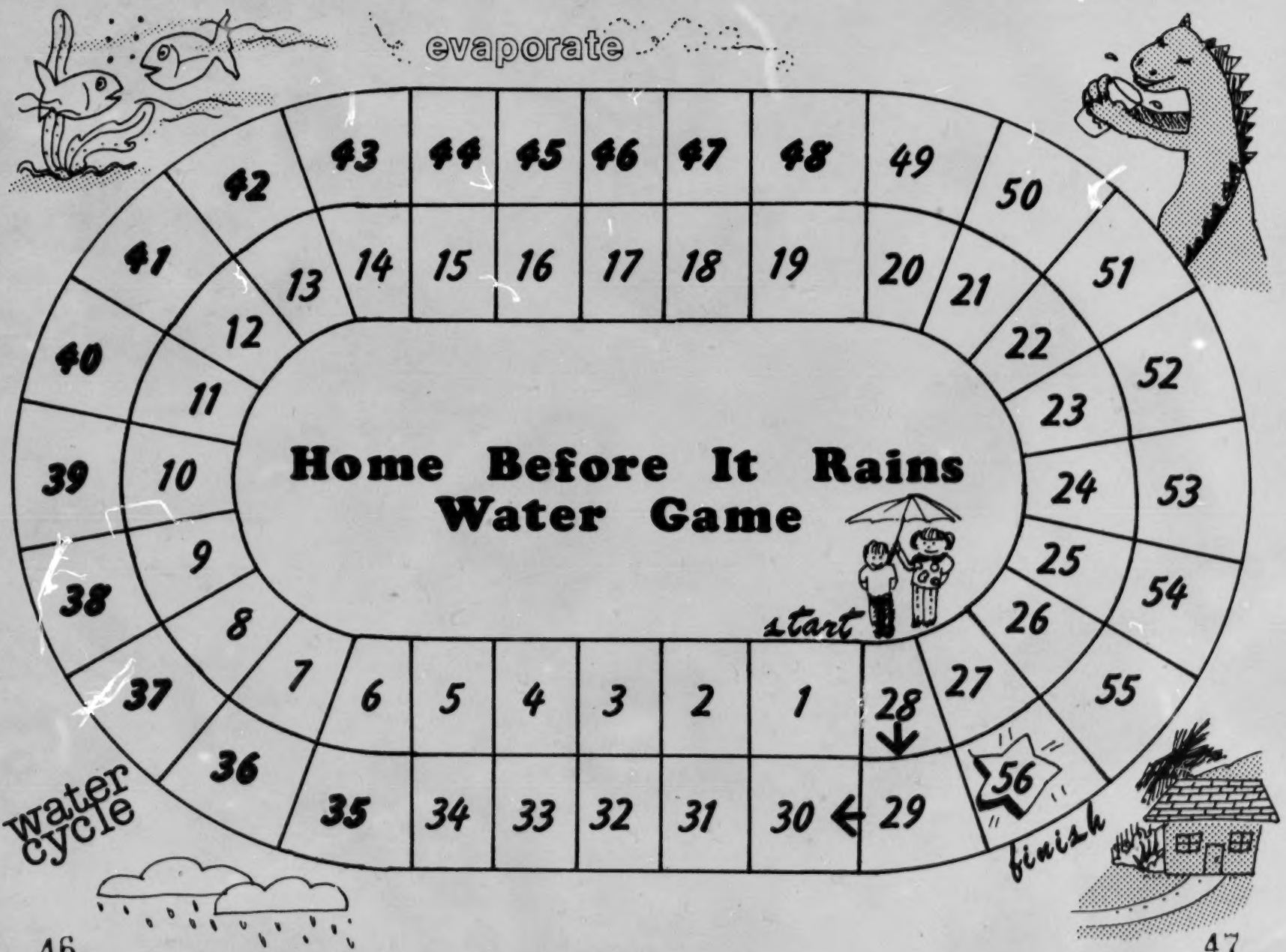
III. SUMMARY

The chief causes for variation in rainfall are location, altitude, distance from the sea, and character of the land. On slopes that are exposed to ocean winds, rainfall is generally abundant. In the case of Oahu the trade winds generally blow from the northeast causing the rain to fall on the windward slopes. The lee side is in the rain shadow. The moisture has already been dropped by the time the clouds reach the leeward (lee=sheltered from the wind) side.

Will it Rain Today?

Notes

Necessary Condition	What process happens
sun, water }	evaporation of water, evaporation } clouds
wind	moves clouds over land
mountains	cloud rise above mountain, cools rain
rain	water storage, run off


evaporate
Home Before It Rains
Water Game
start
finish
water cycle
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T 1.7

A Game: Home Before it Rains

Directions

2-4 players
1 judge

Equipment:

colored markers
die
game board
question cards (shuffle these)
judge's answer sheet

How to Play:

1. Choose a marker and place it on "Start".

2. Roll the die. The number on the die indicates how many spaces you may advance.

3. Before a player may move his/her marker, the player must first draw a question card and correctly answer the question. If the player answers correctly, the player may move the number of spaces indicated on the die. If the player does not answer correctly, the marker must remain where it is until the player's next turn.

4. Judge: Using an answer sheet (provided), the judge will decide whether or not players answer the questions correctly.

Questions for Game Cards

The amount of water on our planet never changes. True or False? (True)

What is the name of the process that causes water to move from an ocean to a cloud? (Evaporation)

Water evaporates at the same speed all the time. True or False? (False)

What factors affect the rate of speed for evaporating?
(Wind, Sun, Temperature)

The water that is found in streams, lakes, oceans and ponds is actually the same water found in clouds. True or False? (True)

Which do you think would evaporate first: A drop of water on a sunny window sill or a drop of water on a desk in a closet? (Window sill)

Could it ever rain without evaporation having taken place? (No)

The amount of water on the Earth never changes. True or False? (True)

All systems must be visible. True or False? (False)

Is the Earth an open system or a closed system? (Closed)

Name 3 different systems.

Is a terrarium an example of an open or closed system? (Closed)

What do the parts in a system have in common? (Each part has a function and all work together to make the whole system work.)

Is it possible that the water you drank yesterday was the same water once used by a dinosaur? (Yes)

What do we call a process that repeats itself over and over again? (cycle)

The water cycle was invented when Robert Fulton invented the steam engine. True or False? (False)

Can cycles be broken? (Yes)

What does <u>recycle</u> mean? (Recycle is to restore an object or material so that it can be used again.)

Give an example of something that can be recycled.

Water, in some form, can not exist everywhere on our planet. True or False? (False)

T 1.7

As water moves through the water cycle, it changes in form. True or False? (True)

Name 2 things that may happen to water after it falls as rain. (Run into streams, soak into ground, absorbed by plants, etc.)

Which is there more of - fresh or salt water? (Salt)

Is the Earth mostly water or land? (Water)

After it falls as rain, how does water get back up? (Evaporation, Transpiration)

Why is salt water much less useful to human beings? (Can't be used in its natural state, ie., non-drinkable)

Complete this sentence: The loss of water vapor by a plant is called _____. (Transpiration)

Most of the weight of the living tissues of most plants is water. True or False? (True)

Name the plant part through which transpiration occurs. (Leaves)

Water taken in by the plant's leaves flows into the roots and evaporates. True or False? (False)

Does much water evaporate from the leaves of green plants? (Yes)

What is the name of the process that causes water vapor to change from gas to a liquid form? (Condensation)

Why are there drops of water on the inside of a lid that has been covering cooking food? (Condensation)

What factors are necessary for condensation to occur? (Water vapor, something cool)

Humidity refers to the amount of water vapor in the air. True or False? (True)

If you set a glass of ice water on a counter top in your house, what happens to the area underneath the glass? (It gets wet.)

Complete this sentence: Dew is one example of _____. (Condensation)

Without oceans, it would never rain. True or False? (True)

Complete this sentence: The clouds in the sky are made up of _____. (Water vapor, water droplets, and possibly ice crystals)

What part of Oahu receives the most rain? (The Windward Slopes)

Does condensation happen before or after precipitation in a water cycle? (Before)

If the wind comes from the Northeast and there are mountains with clouds over them, where do you think the rain will fall? (Mountains)

Pick 2 towns or places on Oahu and tell which you think gets the most rain and why?

WATER AFTER THE RAIN

I. QUESTION

What happens to the water after it rains?

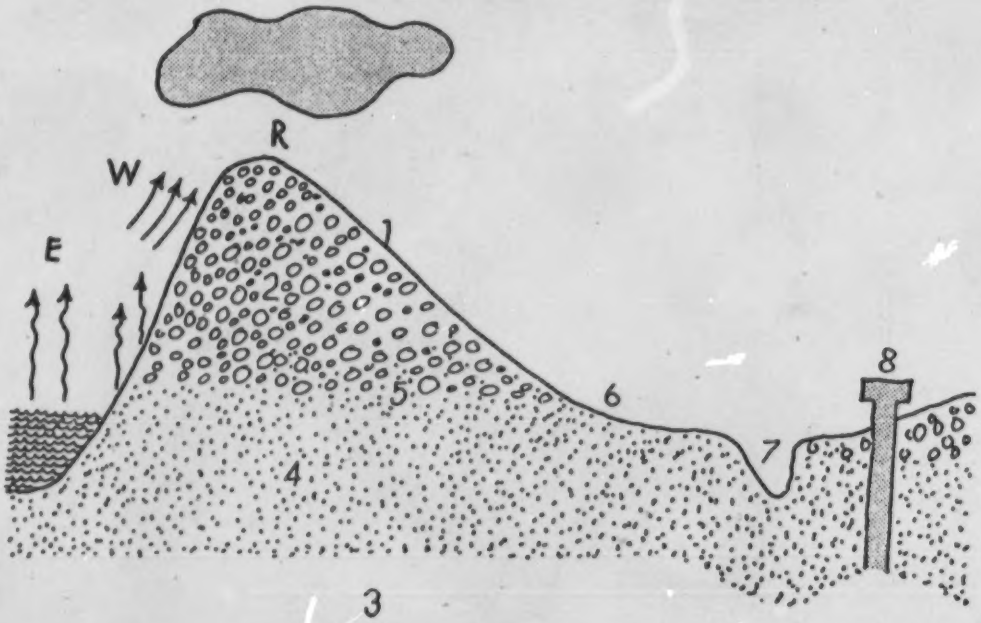
II. DISCUSSION

Approximately 150 inches of rain fall each year on Oahu. In your investigation of the water cycle you have learned that water is not lost but is used over and over and is recirculated in some form. Now think about the water cycle and what happens to all that rain and see if you can complete the matching exercise below.

WHAT TO DO

1. Look at the sketch below. Match the letters and the numbers on the figure with the comments.

_____ As the moist air rises, it cools. Water vapor condenses to form clouds. The clouds continue to receive moisture from the incoming winds and drop the excess moisture on the tops and slopes of the mountains.



_____ The water continues to seep through rock and soil until it reaches non-porous rock or clay. The water cannot pass through such a layer and begins to fill every available crack and pore of the soil.

_____ A stream carries run-off water down the slopes and eventually returns it to the ocean.

_____ The leaves and spongy top soil hold the water and keep it from running downhill until it has time to soak into the ground.

_____ Water evaporates from ocean and land increasing the water vapor in the air.

_____ A hole dug or drilled below the water table will fill with water and result in a well. Water can be pumped from the well or may flow from the well as a result of underground pressure. A free-flowing well is called an artesian well.

_____ Where the water table meets the ground surface, a spring is formed. At the surface, water flows freely from the spring, but may stop flowing if the water table drops during a dry season.

_____ Water percolates through the porous soil and rocks and seeps deeper into the ground.

_____ Winds carry the moist air up the slopes of a mountain.

_____ The top level of the water reservoir is called the water table. The depth of the water table below the ground surface depends on factors and changes during wet and dry seasons.

_____ The water builds up in the soil above the non-porous layer forming a large underground reservoir.

2. Using a colored pen, pencil or marker, trace the flow of water from ocean water through the water cycle back to ocean water.

QUESTIONS TO THINK ABOUT

1. What is the source of energy that drives the water cycle?
2. In what ways could the water in the water cycle become polluted?

WATER AFTER THE RAIN

DIGEST

I. PREPARATION

Each student will need a diagram and matching statements.

VOCABULARY

artesian
ground water
non-porous
porous
saturate
spring
water cycle
water table
well

II. STUDENT ACTIVITIES

Question: What happens to the water after it rains?

1. Students will look at the diagram and match the letter and numbers on the figure with the explanatory comments.

2. Students will trace the flow of water from ocean water through the water cycle.

III. SUMMARY

Rain that falls on the ground may run off or may be absorbed into the soil. This exercise reinforces the identification of the various components of the water cycle.

The sun is the primary source of energy driving the water cycle; the wind also serves as an energy source but the wind is powered by the sun.

For "questions to think about" #2, it may be necessary to point out that pollution can occur at any stage of the cycle and not just be direct pollution of the water body. Encourage thinking of diverse possibilities and stimulate discussion to encompass a wide range of hypotheses.

WATER AFTER THE RAIN

NOTES

Answers for matching:

R As the moist air rises, it cools. Water vapor condenses to form clouds. The clouds continue to receive moisture from the incoming winds and drop the excess moisture on the tops and slopes of the mountains.

3 The water continues to seep through rock and soil until it reaches non-porous rock or clay. The water cannot pass through such a layer and begins to fill every available crack and pore of the soil.

7 A stream carries run-off water down the slopes and eventually returns it to the ocean.

1 The leaves and spongy top soil hold the water and keep it from running downhill until it has time to soak into the ground.

E Water evaporates from ocean and land increasing the water vapor in the air.

8 A hole dug or drilled below the water table will fill with water and result in a well. Water can be pumped from the well or, may flow from the well as a result of underground pressure. A free-flowing well is called an artesian well.

6 Where the water table meets the ground surface, a spring is formed. At the surface, water flows freely from the spring, but may stop flowing if the water table drops during a dry season.

2 Water percolates through the porous soil and rocks and seeps deeper into the ground.

W Winds carry the moist air up the slopes of a mountain.

5 The top level of the water reservoir is called the water table. The depth of the water table below the ground surface depends on factors and changes during wet and dry seasons.

4 The water builds up in the soil above the non-porous layer forming a large underground reservoir.

Oahu's Water Supply

I. Problem

You have been elected Chief Public Relations Officer of the Board of Water Supply. You've been invited to speak to a sixth-grade class on the mainland about how Honolulu's water supply is unique from that of most major cities. After researching available information, prepare the speech or report you will present.

II. Discussion

In many other cities the water supply is primarily surface water (lakes, rivers) and is made ready for use by purification through filters, by chlorination, by aeration or a similar process. But in Hawaii our pure water supply was begun thousands of years ago.

Questions to Ask

The old Hawaiians had a saying: "Uwe ka lani oia ka honua." "When the heavens weep, the earth lives." What do you think this means? Do you think it is true?

What happens to all the rain that comes down? What is the difference between ground water and surface water?

What You Will Need

a copy of "Water Supply" from Exploring Nature in Hawaii, Book V by Sister Mary St. Lawrence, O.P. or Rediscovering Water by Tom Coffman available from the Board of Water Supply, City and County of Honolulu.

HOW TO FIND OUT

Now that you are familiar with the water cycle, read "Water Supply" to discover what is different about the water supply of our islands.

HOW TO TELL ABOUT IT

Present your report to the class using a chalkboard, overhead transparencies, etc.

FURTHER ACTIVITIES

Each year the earth receives more than 3,000 inches of rain. Of this amount 75% falls on oceans, while 25% falls on land. One-third of the rain that falls on the land runs off through streams and rivers and returns to the ocean without soaking into the ground. The remaining, two-thirds percolates into the soil to become ground water.

Using these figures construct some type of graph. Share your graph with the class.

On Oahu approximately 150 inches of rain falls. If we accept that 1/3 runs off compute how much is added to our supply of ground water.

Oahu's Water Supply
Digest

I. Preparation

Each student or group of students will need a copy of "Water Supply" from Exploring Nature in Hawaii, Book V by Sister Mary St. Lawrence, O.P. or Rediscovering Water by Tom Coffman available from the Board of Water Supply, City and County of Honolulu.

Vocabulary

purification
filter
chlorination
aeration
flume
porous
watershed
contaminate
percolate
water table
dike
Ghyben-Herzberg lens
brackish
skim
artesian
caprock
reservoir
cistern

II. Student Activities

Problem: After researching available information, prepare a speech or report telling how Honolulu's water supply is unique.

1. Students will read to discover unique water supply system of Oahu.
2. Students will present a report to the class based on what they have learned about Oahu's water supply.

III. Summary

Students should be able to discuss with familiarity those components that contribute to Oahu's water supply.

Oahu's Water Supply

Notes

For further activities:

if 3000 inches of rain falls on Earth
75% of 3000 = 2250 inches falls on oceans
25% of 3000 = 750 inches falls on land
1/3 of 750 inches = 250 inches runs off
2/3 of 750 inches = 500 inches becomes ground water

if 150 inches of rain falls on Oahu
1/3 of 150 inches = 50 inches runs off
2/3 of 150 inches = 100 inches becomes ground water

Watch How it Happens

I. Activity

By watching a selection from the videotape "Water, Man's Greatest Need" can you put together all you've learned about the water cycle and Oahu's water system in another way?

II. Discussion

The water supply here on Oahu had its beginnings thousands of years ago. To understand our water system, it is necessary to go back and look at the history of the formation of the Hawaiian Islands. Not until you are familiar with such words as glacial melt, dikes, lens, and caprock will you be able to really understand what makes Hawaii's water supply so special.

What you will need

"Water, Man's Greatest Need" videotape
blank paper
pen, pencil, crayons, markers or chalk

How to find out

Watch the 11 minute segment of the videotape that your teacher is about to play for you. Pay particular attention to the new vocabulary and to the concepts you have just learned.

Questions to think about

1. What are things that make the water supply on Oahu unique?

2. Has our water system changed in the last 200 years? If so, how?

3. What would happen to the water supply here if the caprock suddenly disappeared?

4. Why are the mountain ranges here so important?

How to tell about it

With a small group, create a way to show to the rest of the class that you understand the water cycle and Oahu's water sytem. You may do this in a variety of ways using art, music, drama, puppetry, language arts or whatever you think will make the best presentation for your group.

WATCH HOW IT HAPPENS

DIGEST

I. PREPARATION

Before the students begin this activity, you should have the equipment set up and have the video tape "Water, Man's Greatest Need" ready to begin playing from the beginning. Run the tape through counter #262. Additionally, supplies for writing and art work should be readily available. This videotape can be obtained from the TAC office of the Department of Education, Technical Assistance Center (548-6250).

VOCABULARY

glacial melt
dike
caprock
artesian
lens
tunnel
brackish water
porous water

II. STUDENT ACTIVITY

By watching a selection from the videotape "Water, Man's Greatest Need" can you put together all you've learned about the water cycle and Oahu's water system in another way?

The students will demonstrate an understanding of Oahu's unique water supply by presenting to the class art, music, drama, puppetry, etc. to show water cycle and Oahu's water collection system.

The videotape gives background information on the island formation, the coral reefs, and glacial melt that causes the rise and fall of the ocean. The tape explains the importance of and how the layer of caprock was formed. It illustrates the Ghyben-Herzberg lens. The tape explains how the hydrologic cycle, the mountains, the dike formations, and caprock work together to complete Oahu's water supply.

III. SUMMARY

The students will form small groups. Each group will create a way to demonstrate their understanding of the water cycle and Oahu's water system to the rest of the class. This may be done using art, music, drama, puppetry, language arts or whatever they decide upon.

The questions that should be taken into consideration by the students are:

1) What are the things that make the water supply on Oahu unique?
2) Has our water system changed in the last 200 years? If so, how?
3) What would happen to the water supply here if the caprock suddenly disappeared?
4) Why are the mountain ranges here so important?

Evaluation should be based on their apparent understanding of the materials presented thus far, including the new information in the videotape.

Section 2

Use and Control

Instructional Goals

When faced with decisions concerning the use of terrestrial and extraterrestrial resources, students will select practices developed in recognition of present and future environmental and human needs.

Instructional Objectives

Name resources which are used and classify those which are renewable and those upon which people are dependent for basic needs. Sc, SS, N

Identify problems involving soil, water, air and plant life in the community and suggest and defend possible solutions to the problems. Sc, SS, H, N

Illustrate that resources such as iron, coal, water and minerals must be conserved. Sc, SS, Art

Suggest political, social and economic reasons for proposing laws about use of natural resources. Sc, SS, H, C

Design a dramatic production to illustrate the dependence of plants and animals upon water as a resource. Sc, LA, N

Cite examples illustrating how water management and conservation practices have affected the usefulness of land. SS, Sc

Identify individual and community practices that affect quality of both fresh and marine water resources. Sc, SS, H

Identify and map a local watershed. Sc, SS

Estimate the cost of water one uses per year if water costs 77¢ per 1,000 gallons.* M

* Price data current as of November 1, 1980

Performance Expectations

Identifies causes of local environmental problems.

Conducts simple investigations to gain first-hand information on environmental matters.

Identifies instruments or methods that can be used to gain information about environment or to change an environment for a desired result.

Identifies recreational opportunities in both human-made and natural environments.

Describes the environmental factors which must be considered to conduct various recreational activities.

Names industries that are directly dependent on natural resources.

Explains the need for rules to protect the environment.

Identifies state and federal government agencies primarily concerned with environmental management or control.

Lists a number of environmental factors which may affect the emotional or physical health of human beings.

Cites examples of negative and positive ways human beings can change the environment.

Identifies and describes environmental factors which influence the beliefs of difference cultures.

Identifies specific contributions one can make to help human beings live in harmony with the environment.

Essential Competencies

Use computational skills in situations common to everyday life.

Read and use scales on standard measuring devices.

Reach reasoned solutions to commonly encountered problems.

Uses resources for independent learning.

Demonstrate knowledge of the basic structure and functions of national, state and local governments.

Demonstrate knowledge of important citizen rights and responsibilities.

Section Objectives

Identify various water uses.

Become aware of the amount of water required for various activities.

Illustrate the necessity for a usable (potable) water supply.

Relate water use to water quality.

Practice classification skills.

Graph and visually represent statistical data.

Develop mathematical skills such as computation and measurement relative to problem solving methods.

Practice data collecting techniques and skills.

Use art as a means of communication.

Gain an understanding of Hawaii's unique water system history and regulations.

Become aware of the importance of water and the way it affects our lives.

Generalize about the nature and extent of the interrelationship between water control and increasing varied demands.

Water is essential

AIR WATER FOOD

Three Vital Resources

I. Question

Of all the rain that falls in our country, about 7,500 gallons each day for every man, woman, and child in the United States is available for use. The United States is well blessed as compared with most countries of the world. What do we do with all this water?

II. Discussion

Water is certainly essential for survival! You know that all the water the Earth ever has had or ever will have is the same water we now have. A large amount of water is required to grow the food we eat. Without an adequate supply of water, we could not feed our population. In many ways our lives and health depend on water for washing. An enormous water supply is required in order to maintain business and industry.

Our military and defense systems must be furnished with readily available water. We use water for recreation. We use water around the home, too.

What to do

List as many ways as you can that show how water is used. Work with a partner, if you like. You might check the yellow pages of a telephone directory to see if there are businesses or industries that use water.

How to Tell About It

1) Ask your teacher to put a large sheet of paper titled "Water Uses" on the board. Each student can then add to the list any water use that is not already written. Leave this list up during the day. How many uses are listed by the end of the day?

2) Illustrate one use of water. Make your illustration colorful. Everyone's illustrations may then be used to make a large water-use collage.

Questions to Ask

Are all the uses essential? Is all water used for or by people? How many of the uses are ones that you personally use?

Additional Activities

1) Using your list of water uses, think how these uses could be grouped. Rewrite your list as you group the uses. Working with a partner might be helpful.

2) If water use is grouped into these categories: public, industry, agriculture, and other (including military), estimate or guess which group on Oahu uses the most amount of water, the second most, etc.

3) After guessing about which group uses the most water, your teacher will give you the actual statistics. Using those figures, construct a graph.

Extend Your Thinking

1) Why do you suppose that use of water in factories is increasing more rapidly than home and city use?

2) Is it possible to increase the amount of water available? Explain your answer.

WATER IS ESSENTIAL FOR SURVIVAL

DIGEST

I. PREPARATION

1. Title a large sheet of paper "Water Uses" and post in a central classroom location.
2. Provide a large sheet of paper, posterboard, etc. for group "Water Use" collage.

VOCABULARY

essential

II. STUDENT ACTIVITIES

Question: What do we do with all the water that falls as rain?

Students:

1. List ways water is used.
2. Compile a class list of ways water is used.
3. Illustrate one use of water. The class illustrations will be used in making a collage.

III. SUMMARY

Which of the uses of water are essential? Should some uses receive higher priority? Which ones? Could more water be made available? If so, how? Would water use determine the water quality needed?

WATER IS ESSENTIAL FOR SURVIVAL

NOTES

For additional activites, these categories might be used:

Public, Business and Industry, Agriculture, Military.

The actual statistics for Oahu show that of the water used, 27% is used by the public - including businesses, industries, tourists, small farmers, private homes, etc.; 7% by the military, 7% by private systems; 60% by sugar cane growers. These figures can be used as the basis for a bar or pie graph. These figures are based on the amounts drawn from the Oahu supply. However, sugar cane plantations are not governed or metered by the Board of Water Supply. As an alternative way of looking at water consumption: 410 million gallons are used per day; approximately 170-180 million gallons is used by Board of Water Supply customers, 230-240 million gallons is used by sugar growers. To more closely look at the amount used by Board of Water Supply customers there are these figures:

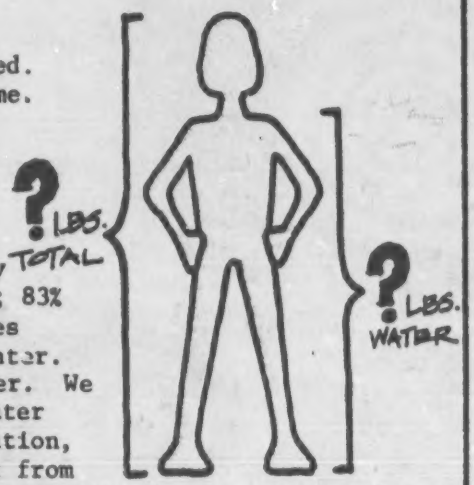
Single family residences	41.6%
Multi-family residences (apartments, condos)	17.4%
Commercial (stores, shopping centers)	13.5%
Hotels (tourists)	5.6%
Industry	6.5%
Military	2.7%
U.S. gov't - Federal Buildings	0.1%
State government	7.0%
City government	3.2%
Agriculture (small farmers, nurseries)	1.8%
Religious	0.6%

WATER, OUR 2ND MOST VITAL RESOURCE

I. ACTIVITY

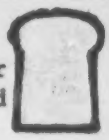
Find out how much water you need.
Figure out how much water you consume.

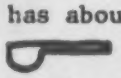
II. DISCUSSION

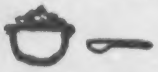


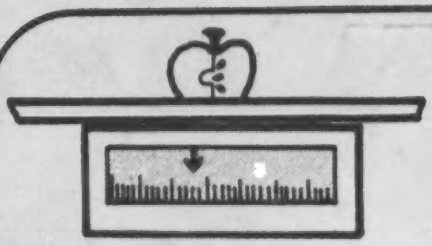
We must drink and eat a large amount of water each day to stay alive and healthy. Seventy to ninety percent of our body weight is water; 83% of our blood is water. This compares to a jellyfish which contains 95% water. or a chicken which is about 74% water. We can lose up to five pints of this water each day through exhalation perspiration, and urination. If the water we lost from our bodies is not replaced, we cannot survive for longer than 5 days!

Problem
How much water do you eat and drink?



has about  of water

has about  of water



WHAT TO DO

1) Weigh yourself, then calculate the percentage of water weight in your body. You lose about 5 pints of water from your body per day and must replace it with water consumed in food and beverages.

What percent of your body's water weight do you lose each day? What percent is that of your total weight? (Hint: you will need to find out how much one pint of water weighs before you can do this!)

2) Most of you probably do not drink 5 pints of plain water each day, yet you do replace that much water in your body somehow. How do you do it? Where does all the water come from? Almost any food you can think of contains some water, even things like cereal and bread which seem very solid.

HOW TO DO IT

Keep a record of <u>everything</u> you eat and drink for 2 days. Make a list of these foods and estimate how much water they contain. "Juicy" foods such as apples, celery, potatoes, lettuce seem to contain alot of water, and they do. A tomato is about 85% water, pineapple 87%, corn kernel 70%, sunflower seed 5%. To figure out how much water is in the "watery" foods you eat, first put them in a measuring cup and record the amount before you drink or eat it. To estimate the water content of other foods, you should cut off a little piece of food, place it on a scale platform and record its weight. Then leave the food for a few days or longer to dry out. For faster drying, place the food in an oven set on a low temperature. Heat the food slowly in the oven for several hours. Weigh again, and compare the "dry" weight with the original weight. Where did the rest of the weight go? What percent was water? From your record, how much of all you ate and drank was water?

HOW TO TELL ABOUT IT

Construct a chart, table, diagram or graph to show what you found out in activities 1 and 2. Present it to the rest of the class or display it in your classroom.

QUESTIONS TO THINK ABOUT

1) Compare your daily activities with those of your mother, father or friend. Who do you think needs to replace the most water? Why?

2) Can all foods be dehydrated? What are some advantages of dehydrated foods?

WATER, OUR 2ND MOST VITAL RESOURCE

DIGEST

I. PREPARATION

The following materials/equipment should be obtained or made available:

one pint container
water
scale (Possible arrangements can be made to borrow nurse's scale or to have students go to office to weigh themselves. If neither is feasible, ask students to weigh themselves at home.)
balance scale
measuring cup

VOCABULARY

dehydrated
percent

II. STUDENT ACTIVITIES

Activity: Find out how much water you need. Figure out how much water you consume.

1. Calculate percentage of water weight in your body.
2. Compute the amount of water consumed daily in foods and beverages.

These activities will involve weighing and measuring. Math skills such as graphing, computation, estimating, measuring can be emphasized. Nutrition education is a natural follow-up to keeping a food diary. Art can be encouraged in the preparation of the summary project.

Many of the investigation activities can be conducted at home, then shared with the class, if limited time is a factor.

Percent of Water in Certain Tissues

Animal	% Water	Plant	% Water
Jellyfish (total)	95	Tomato	95
Chicken (total)	74	Pineapple	87
Human being: blood	83	Corn kernal	70
Human being: tooth enamel	2	Sunflower seed	5

III. SUMMARY

Students should construct a chart, table, diagram or graph to show findings of activities 1 and 2. Present it to the rest of the class or display it in the classroom with the ones others have made.

150 Gallons a Day?

I. Question

How much water is used for various purposes? How does your town use water? How do you use water?

II. Discussion

Begin with yourself. Keep a record of your daily use of water.

Questions to Ask

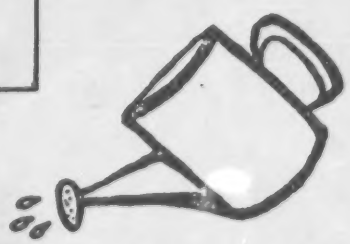
How much water do I use when brushing my teeth? How many times each day do I brush? How often do I wash my hands - How much do I use? How often do I flush the toilet?

What to do

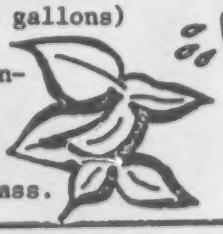
1. Think of all the ways you use water each day. Make and complete a chart similar to the following:

Activity performed	Amount of water used	Frequency of activity	Total amount of water used

(hints: flush a toilet - 5 gallons
tub bath 30-40 gallons
shower bath 20-30 gallons)



2. Mark each activity you consider essential with a check mark.
3. Compare your results with another member of your class.



ADDITIONAL ACTIVITIES

1. Using the figures obtained from #1 in "What to Do" determine the average water use per person in your class. Using that average how much water would your entire class use? Your school? Your community? Oahu?

2. Figure out the amount of water you have used thus far in your lifetime. Is the amount of water used related to age? Would an older person use more/less water than you do? Explain your answers.

3. Working in small groups, devise a questionnaire to use for surveying the people in your neighborhood about water use and amounts used. After completing your survey, work with your group and report your findings to the class.

4. An "average" city uses 70 million gallons of water each day. If each person in the United States uses approximately 150 gallons per day, how large is an "average" city? Is your city average?

EXTEND YOUR THINKING

1. List some home uses of water which were not common 50 years ago.

2. Why do you suppose urban families use almost six times as much water as farm families?

3. When did plumbing become common in homes and apartments?

4. Were there large cities before plumbing became common?

150 Gallons a Day?

Digest

I. Preparation

This activity requires very little teacher preparation as students will be conducting investigations to obtain most of the information.

Vocabulary

frequency

II. Student Activities

Question: How much water is used daily, for various purposes?

The students keep a record of their daily water use. They should think about and discuss how much water is used brushing teeth, washing hands and flushing toilets. As an activity, they will each make a chart that shows all the data they collect, then compare results with other class members. When the students mark the activities they consider essential, they are beginning to evaluate their personal water consumption and make some value judgments. At this point, it would be helpful to interject questions and stimulate discussion about the things that they took into consideration when making their decisions. This may be extended to a discussion of school, community and island water consumption, and may include surveys that students can conduct in their neighborhoods as home assignments.

III. Summary

Students share the information they obtain independently or in small groups largely through the use of charts and discussion. This activity is designed to promote consideration of the amount of water consumed in normal daily activities, and to raise students' awareness of their priorities for personal consumption.

150 Gallons a Day?

Notes

Below is a li[illegible] of some examples of amounts of water used in normal daily activities. It might be interesting to allow students to estimate how much each activity takes before sharing these figures with them. Once they have completed their charts however, an interesting comparison can be made of the amount used "normally" and the amount used when an attempt to conserve is made.

WATER CONSERVATION... Something To Think About!

Some Revealing Facts To Help You SAVE WATER

EXAMPLES	NORMAL USE	CONSERVATION USE
SHOWER	Water Running 25 Gallons	Wet Down, Soap Up, Rinse Off 4 Gallons
BRUSHING TEETH	Tap Running 10 Gallons	Wet Brush, Rinse Briefly ½ Gallon
TUB BATH	Full 36 Gallons	Minimal Water Level 10 to 12 Gallons
SHAVING	Tap Running 20 Gallons	Fill Basin 1 Gallon
DISHWASHING	Tap Running 30 Gallons	Wash and Rinse in dishpans or Sink 5 Gallons
AUTOMATIC DISHWASHER	Full Cycle 16 Gallons	Short Cycle 7 Gallons
WASHING HANDS	Tap Running 2 Gallons	Fill Basin 1 Gallon
TOILET FLUSHING	Depending On Tank Size 5 to 7 Gallons	Using Tank Displacement Bottles 4 to 6 Gallons
WASHING MACHINE	Full Cycle, Top Water Level 60 Gallons	Short Cycle, Minimal Water Level 27 Gallons
OUTDOOR WATERING	Average Hose 10 Gallons Per Minute	Lowest Priority, Eliminate

Figures Supplied by American Waterworks Association

WATER USE AT YOUR SCHOOL

I. QUESTION

How much water is used by the students in your school each day?

II. DISCUSSION

You have thought about the ways water is used and you have found out how much water you use. Let's now try to determine how much water is used by the students while they are in school each day.

WHAT TO DO

Make a survey of the amount of water that the students in your school use each day. To begin with, you may want to limit this just to the water that is drunk.

HOW TO DO IT

Assign a number to each drinking fountain in your school. First find the average amount of water used in one drink at each fountain. Then collect data on the number of students who drink at each fountain. Calculate the total amount of water used for drinking at each fountain.

HOW TO REPORT IT

Complete a chart such as the following:

Fountain number	Average amount of water used for one drink	Number of drinks per day at each fountain	Total amount of water used at each fountain

ADDITIONAL ACTIVITIES

1. How much water is used for other purposes throughout your school? Using this same method, you can collect data on water used for washing, classroom activities, restrooms, custodial, cafeteria and school yard use.

2. In your investigations, did you observe any water being wasted? Was water left running when the tap should have been turned off? Think of a way to find out how much water is wasted by a dripping faucet.

3. Make posters to be placed near water sources urging conservation.

WATER USE AT YOUR SCHOOL

DIGEST

I. PREPARATION

The class will need to be organized into groups or teams of 2-3 students each. Each group should be assigned a drinking fountain to monitor. If possible a copy of the school's water bill showing the amount consumed would be helpful. Additionally, prearrangements might be made with the custodial, cafeteria and yard staff to use them as resources for students in their investigation.

VOCABULARY

calculate
data
conservation
custodial

II. STUDENT ACTIVITIES

Question: How much water is used by the students in your school each day?

1. Students will make a survey of how much water is used by the students in their school each day.

Additional activities include investigating how much water is used throughout the school for purposes other than drinking and the construction of posters urging conservation.

III. SUMMARY

Students should report their findings by displaying water use charts or by group discussion and oral reports. Excellent opportunities exist for integration of whatever math skills are being covered as well as social studies, art and language arts. Emphasize as many of these areas as possible when presenting and summarizing the activities.

WHO CONTROLS THE WATER?

I. QUESTION

You know how important water is to our daily lives and in how many different ways it is used. The next thing to consider is who owns it?

II. DISCUSSION

After understanding the natural water system and the ways our society uses water, it is important to begin thinking about the ways in which water is controlled. Questions such as: Who owns it? How is it regulated? must be asked in order to understand the water situation in Hawaii today. Water is so much a part of our every day lives that it is often easy to take for granted; yet in Hawaii, we cannot afford to do that. The amount we have is limited while the demands we place on it are rising. There must be some way of maintaining control of this precious resource.

WHAT TO DO

1. Watch a selected segment of this videotape: "Water, Man's Greatest Need." As you are watching, try to list the different ways that water has been controlled in Hawaii. When the tape is finished, look back at your notes, compare them with several other people, then make a list of as many things that you all remember were said to be methods of control.
2. Trace history of water rights in Hawaii. Make a time line in any way you choose to show how water has been controlled.

QUESTIONS TO THINK ABOUT

1. Compare the early Hawaiian control of water with today's modern ways. Which do you think is more effective? More fair? Why?

2. Which of Hawaii's uses of water seems most important? Should that use be given priority water rights?

3. What are some problems with the present method of water control in Hawaii? How might they be solved?

ADDITIONAL ACTIVITIES

1. Write, telephone or interview in person someone from the Board of Water Supply to find out more about water rights and water regulation in Hawaii.

2. Make a directory of all the resources (books, pamphlets, people, tapes, filmstrips, etc.) you can think of that would be helpful to someone writing a report entitled "Hawaii's water: Who owns it? Who regulates it?"

3. Divide into groups and have a panel discussion or debate on the topic "Water should be free to everyone in Hawaii!" You'll need to do some thinking and research before you defend your position.

4. Create some "commercials for public television" pretending that you represent the military, the taro farmers, the Hawaii Visitors Bureau, the general public or another group that you have found places demands on Hawaii's water. Imagine this situation: The present system of control and regulation of water is being reviewed and a new policy is going to be developed to decide who will get how much water. You want to convince the Board that your interest group deserves a greater percentage of water supply. Support your position with as much background information as possible.

WHO CONTROLS THE WATER?

DIGEST

I. PREPARATION

Videotape "Water, Man's Greatest Need" segment/counter #197-524, approximately 20 minutes.

VOCABULARY

artesian
dike
head level
shaft
regulation

II. STUDENT ACTIVITIES

Question: Who owns the water?

1. Students, as they are watching the videotape, will list the different ways that water has been controlled on Oahu.
2. Students will construct a time line showing when and how water has been controlled on Oahu.

III. SUMMARY

"Questions to think about" should be discussed to emphasize the need for future water decisions - priority uses and regulation.

Who Controls the Water?

Notes

1. Students may contact Board of Water Supply for information about current status of water rights and water regulation on Oahu.

2. Students may make a resource directory listing sources of information about Oahu's water.

3. Students may debate the topic "Water should be free to everyone on Oahu!"

4. Students may create commercials for various groups demanding Oahu's water.

The following items might be included on a time line:

1580-1778	Early Hawaiian control. Watershed areas protected and controlled by chiefs. The amount of water taken was determined by need. Taking more than allotted or depriving someone of his share was a crime punishable by death.
1778	Capt. Cook's arrival, and subsequent vessels created new water uses and water shortages.
1840	Streams diverted to cane fields.
1848	Pipe laid from Nuuanu taro patches to the harbor to provide water for whaling vessels.
1880's	First tapping of underground lens; artesian wells drilled.
1890	Drought
1895	First public use of underground water.
1915	After the water commission report and scandal, a new agency headed by Fred Ort was established. Ort metered the water, capped wells, increased rates, imposed limits, sealed leaky wells.
1916	McCanlis tapped dike water; sold water rights to cane growers.
1920	Board of Water Supply established.
1923	Drought
1942-1944	Halawa shaft built, water skimmed from top of lens.

WHO CONTROLS THE WATER?

NOTES

1944-1945	Military shaft at Red Hill.
1945,1947	Ort appealed for establishment of one unified water management agency.
1951	Ort retired. Water management still same today as 1950's.

Section 3

Distribution

Instructional Goals

When faced with decisions concerning the use of terrestrial and extraterrestrial resources, students will select practices developed in recognition of present and future environmental and human needs.

Students will examine optional courses of action and their consequences for improving the quality of life and will support those that will provide optimum short and long-term benefits for society and the environment.

Instructional Objectives

Cite examples illustrating how water management and conservation practices have affected the usefulness of land. SS, Sc

Identify individual and community practices that affect quality of both fresh and marine water sources. Sc, SS, H

Illustrate how delay increases the cost of cleaning up water. SS, M

Observe and describe the steps that are necessary to produce potable water at the faucet in the home (or school). Sc, SS, H

Identify local practices which affect the beauty of the community. Sc, SS, H, Art, HS

Give examples of steps which might be taken to prevent or minimize pollution by some of the following: self, family, neighborhood, industry, towns, cities, countries, states, federal government, United Nations, nations of the world. Sc, SS, H, C, V

List the uses and abuses of natural resources observed during a recent field trip. LA, H, Sc, SS, C

Performance Expectations

Explains the effects of environmental changes on recreational opportunities.

Conducts simple investigations to gain first-hand information on environmental matters.

Cites examples of occupations that are primarily concerned with the study or control of specific environments.

Identifies causes of local environmental problems.

Describes the impact of various industries on the environment.

Cites examples of negative and positive ways human beings can change the environment.

Essential Competencies

Communicate orally in situations common to everyday life.

Demonstrate writing skills commonly used in daily life.

Reach reasoned solutions to commonly encountered problems.

Use resources for independent learning.

Identify the training, skill and background requirements of a least one occpation in which the student is interested.

Demonstrate knowledge of important citizen rights and responsiblilities.

Section Objectives

Gain an understanding and appreciation of the technology involved in the water delivery and disposal systems.

Gain an appreciation of the complexity of the water delivery system.

Develop skills in research related activities.

Develop skills in report writing.

Develop skills in model making.

Develop skills in oral presentation.

Develop skills in designing and carrying out assignments on a group basis.

Our Water Supply

I. Question

How does Hawaii get its water?

II. Discussion

The article "Water Supply" was published in 1961. Since that time, 18 years ago, many changes have taken place. The population has increased - especially on Oahu and Maui. Has this increase had an effect on the supply of water?

Activities

1) This class has been chosen to revise and update the material in this article for inclusion in a new book on water supply in Hawaii. To keep the assignment simple the class is divided into several groups - based on the section assignments. Each group is responsible for editing the material and for the accuracy of the contents. Include new diagrams and pictures if necessary. Use the materials in the room, the library, and talk with the Board of Water Supply.

2) Section assignments:

Group 1: Dikes

Group 2: Lens

Group 3: Halawa Shaft

Group 4: Artesian Water

Group 5: Purification

Group 6: Hawaiian Wells

Group 7: Other Islands

3) Combine the articles written by each group into a new "Water Supply" article.

4) Compare the new article with the 1961 version. Has there been much change? If so, why?

Our Water Supply

Digest

I. Preparation

Materials:
Water Supply reading booklet - taken from Exploring Nature in Hawaii, Book V, "Water Supply" pp.40-47
Materials/references from Board of Water Supply

Vocabulary

purification
conserve
artesian water
dikes
Halawa Shaft

II. Student Activities

Question: How does Hawaii get its water?

Divide class into several working groups. Each group chooses or is assigned one topic and prepares a news article for publication. Include pictures and diagrams, if necessary.

Group 1 - Dikes

Group 2 - The Lens

Group 3 - Halawa Shaft

Group 4 - Artesian Water

Group 5 - Purification

Group 6 - Hawaiian Wells

Group 7 - Other Islands

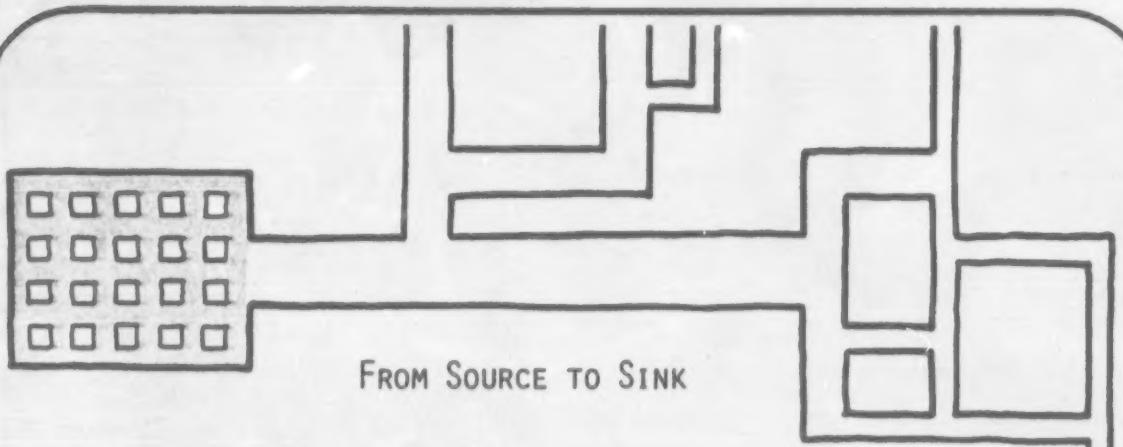
III. Summary

1) Make a composite article from the articles written by each group.

2) Compare new information with the old. Has there been much change? If so, why?

Activities and discussion are based on Exploring Nature in Hawaii, Book V "Water Supply" which students have used previously. Each student should have a copy of this reading.

You will notice that this article "Water Supply" was written in 1961. Since that time many changes have taken place. The population of Hawaii and especially Oahu and Maui has greatly increased. Has this increase had an effect on the supply of water? In recent years people have been told that we must conserve water. Why? Are our sources of water running dry?



FROM SOURCE TO SINK

I. QUESTION

How does the water get from its source to our sink? How does it stay clear and clean?

II. DISCUSSION

The water that comes out of the tap on the water fountain has generally traveled a great distance to get there. Not only has it traveled through a maze of pipes, it arrives as drinkable water, clear and clean. How does all this take place?

ACITIVITIES

1. Find out the meaning of the following terms as they are used in talking about water.

   a. normal peak demand
   b. per capita consumption
   c. water pressure
   d. reservoir
   e. pumping station
   f. gravity distribution
   g. purification
   h. aeration
   i. settling
   j. filtering

2. Have an engineer from the Board of Water Supply talk with the class about the water distribution system in Hawaii. Ask the engineer to bring along diagrams of the distribution system.

3. Organize the class into groups. Each group should design and build a model distribution system or make a large scale drawing to put on the bulletin board. Within each group the following tasks need to be done:

   Task 1 - design the system to be built.

   Task 2 - collect materials needed for the building - cardboard cylinders, PVC pipe (if possible), garden hose etc. anything that could be used.

   Task 3 - clear out a work area for the model or if it's to be a drawing, make space available on the bulletin board.

   Task 4 - make a list of the terms used in the distribution, purification process with their meanings to be displayed with the model.

   Task 5 - build the model.

SUMMARY

1. Display the model systems.

2. Discuss the water purification system in more detail.

3. How do those people not living in areas on the water distribution system get their water?

ADDITIONAL ACTIVITIES

1. Do a detailed study of the water purification system.

2. Look into alternate water collection and distribution systems -

   a. well water
   b. artesian well
   c. cistern

From Source to Sink

Digest

I. Preparation

These materials should be collected by the students or made available: cardboard inserts from paper towels, bathroom tissue etc., straws of different sizes, misc. collection of hollow cylinders of different sizes to use for making a model water distribution system.

Vocabulary

engineer
normal peak demand
per capita consumption
water pressure
reservoir
pumping station
gravity distribution
purification
aeration
settling
filtering

II. Student Activities

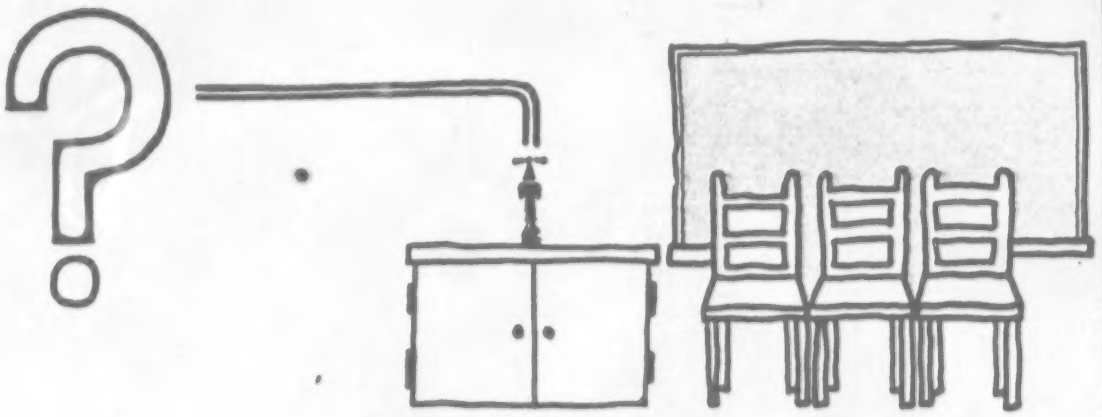
Question: How does the water get from its source to our water tap?
How does it stay clear and clean?

Review with the class what they already know about water in Hawaii - where it comes from and where it's stored until it's needed. Now the problem to be considered is how it gets from these sources to the sink in a home. The water that arrives at the sink has probably traveled through a large number of pipes over distances of many miles, has been pumped up the hill, if one lives on a hill, and has gone through a purification treatment. This feat is something of an engineering accomplishment in itself - but combined with the fact that a steady rate of flow continues into homes, businesses, schools and fire hydrants the distribution system must be considered a marvel of technology and engineering.

If possible, have an engineer from the Board of Water Supply come in and discuss this with the class. If a speaker is not available, have students obtain through the Board of Water Supply some diagrams and materials showing the distribution system.

III. Summary

Students should be able to discuss Oahu's water distribution system. Alternate water collection and distribution systems could be investigated - well water, artesian wells, cisterns.



How Does Water Get To The School?

I. Question

How does water get to the school? How does water get into the classroom?

II. Discussion

When you turn on the faucet on the classroom sink, or while standing in the shower at home have you ever stopped to think about how the water got from its source into your home or classroom? Not many people would stop to think about the water distribution system; it's just taken for granted - at least until the sink backs up or other plumbing failures happen. In this activity we will explore this water distribution system, and get some idea of how it operates within the school building.

ACTIVITY

Divide the class into four groups:

Group 1: Locate the water main leading into the school. Locate the pipe taking the waste water from the school.

Group 2: Locate the water pipes leading into the classroom, or nearby sink. Trace them backwards as far as possible toward the place they come into the building. Make a rough sketch of this route.

Group 3: Locate a hot water pipe - probably in the cafeteria - and trace this pipe backwards towards the place where it enters the building. Make a rough sketch of this route.

Group 4: Locate or draw a map of the school with the results of the findings of groups 1, 2 and 3.

SUMMARY

1. Compare your drawing with the actual drawings or blueprints obtained from the school office or custodian.

2. Take a walking tour of the school's water pipe system with the school custodian - note such things as main shut off valves, main pipe joints, water meter etc.

ADDITIONAL ACTIVITIES

1. Make a drawing of the water distribution system in your house and neighborhood. Note the main shut off valve, water meter, hot water system etc.

2. Make a map of something else you cannot see.

How Does Water Get to School?

Digest

I. Preparation

The following materials will be needed:

1. Map of school's water distribution system - generally available in blueprint form through the maintenance or administrative office.

2. Arrange with the custodian a tour of the school's water distribution system. The custodian should, if possible, lead this tour.

Vocabulary

access areas
water main
blueprint
distribution

II. Student Activities

Question: How does water get into the school? How does it get into the classroom?

Divide the class into four groups as outlined on student task card.

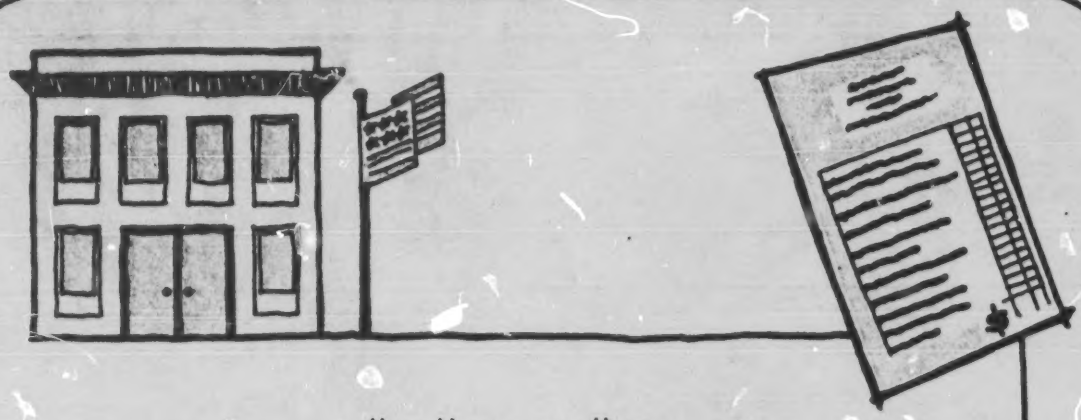
Discuss with students what they know about how water gets from the source into their homes. Ask if they have noticed the access holes within streets or sidewalks that are generally covered with large heavy metal rings. These covered holes (at one time referred to as manholes but since women's lib are generally referred to as access areas!) are accesses to the water mains, electrical systems, and gas mains. Each home and building has one water main (one large water pipe) which carries the water from a larger pipe into the home. Once in the home, how does it get around? How is it distributed in the school? Does anyone recall seeing a water access hole in the school yard? Where do the water pipes come into this classroom? How does it get from the larger water main into the room? These are the questions to be answered in this activity.

III. Summary

1. Compare the results of the class work with an actual map or blueprint drawings of the school's water distribution system.

2. Have the custodian lead the class on a tour of the school's water distribution system. Utilizing the custodial staff in a teaching capacity provides a way of integrating career education in a very natural way.

If students do the two optional activities, follow the same type of comparison and sharing summary procedure that was used in the above activity.



How Water is Used In the School And Water Cost

I. Question

How is water used within the school? What or who are the largest users of water in school? How much does the water cost?

II. Discussion

Look around your home and the school and notice how many sources of water there are and how many uses of water there are. How many times a day do you turn on a faucet or use water in any way. What does this convenience cost in terms of dollars? Are all these uses necessary? In order to get a feeling for how and how much we use water we will investigate the uses of water within the school and the cost of this water to the taxpayer.

Activity

1. Discuss ways in which you can find out about water uses in the school.
2. Design and make an inventory of all the water uses in the school building and school yard.
3. Tabulate the results of water use inventory. Make a chart showing the information.

SUMMARY

Discuss:

1. Where do you think the most water is used?
2. What sources of water might be turned off if you had to cut back?
3. Could anything be done to cut down on water use and thus water costs?

ADDITIONAL ACTIVITIES

1. Record your own use of water for at least one 24 hour period. Are all these uses necessary?
2. Look at your family's water bill and water use. Are there ways you can cut back on water use?

How Water is Used in the School and Water Cost

Digest

I. Preparation

The following materials will be needed:

1. Transparencies of one to two of the school's water bills.
2. Map of the school or diagram to use with groups to show areas of counting.

Vocabulary

meter reading
tabulate

II. Student Activities

Question: How is water used in the school and how much does it cost?

Show the transparency of the bills and note the rather large cost of supplying water to the school. Note the meter readings and how much water was used in the two months time. Do rates of use change much during vacation periods etc. Pose the question - How can we tell how the water is is used in the school?

1. Have students come up with ways they can find out about water use in the school. (Ask principal, custodian or find out from them who might know.)
2. On the board, on a chart or with the overhead projector make a listing of all the water uses in the school they can think of.
3. Divide class into groups in order to make a complete inventory of all water uses in the school. Note hot water and cold water uses. If possible show on school map what group will be going where.

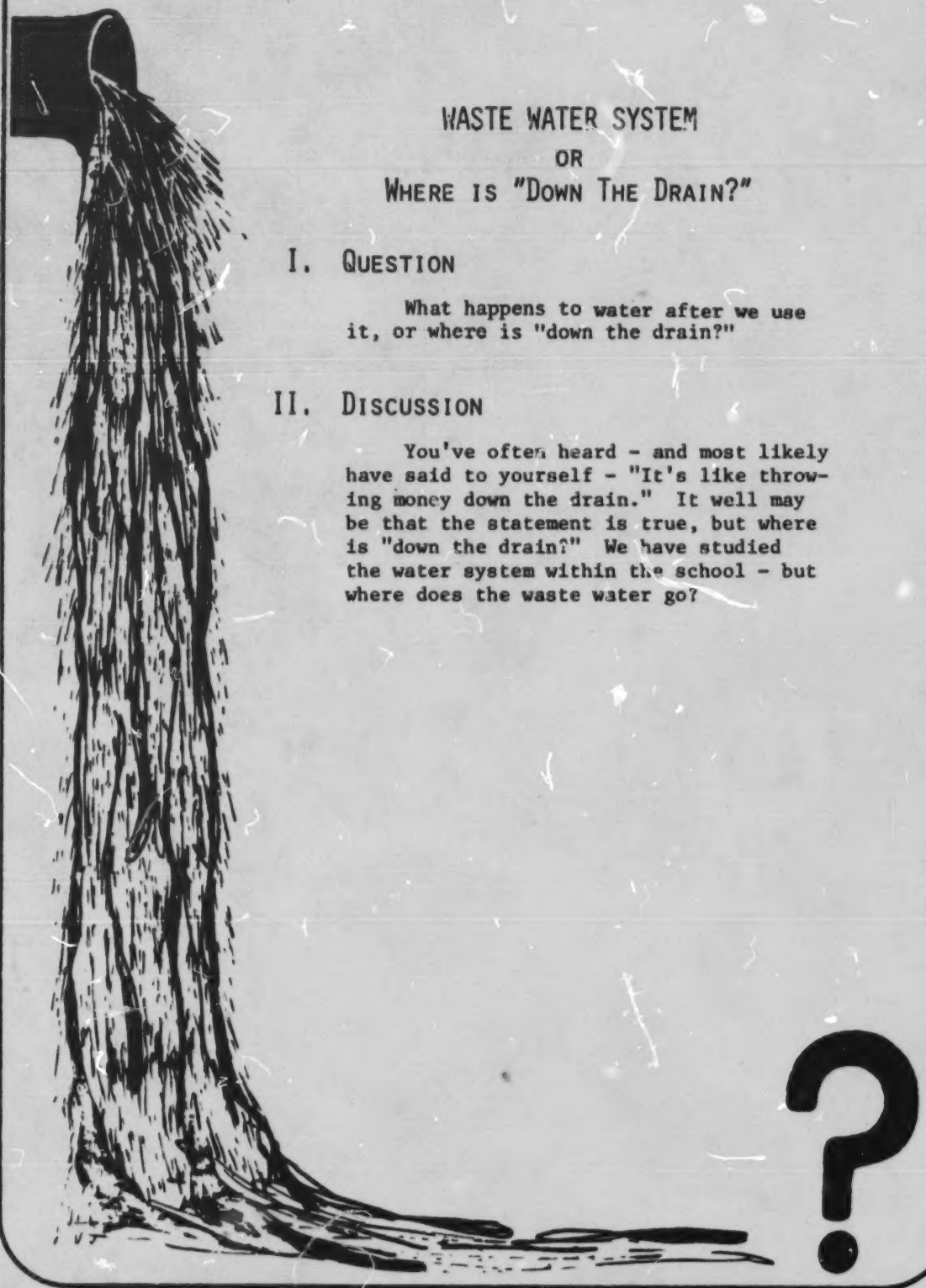
III. Summary

After students tabulate the information they obtain and display in a chart or other visual form, pose open ended questions for thought such as -

a. Where is most water used?

b. If you had to cut out some uses which would you select?

c. Can anything be done to cut down on the use/costs?



WASTE WATER SYSTEM
OR
WHERE IS "DOWN THE DRAIN?"

I. QUESTION

What happens to water after we use it, or where is "down the drain?"

II. DISCUSSION

You've often heard - and most likely have said to yourself - "It's like throwing money down the drain." It well may be that the statement is true, but where is "down the drain?" We have studied the water system within the school - but where does the waste water go?

ACTIVITY

1. Divide the class into 4 groups. Each group will prepare materials to present to the class on their chosen topic. Include pictures and diagrams and list advantages and disadvantages.

   Group 1: Finds out where the waste water from the school goes and what sort of treatment it undergoes and where it's finally dumped.
   Group 2: Prepares materials and information on a primary treatment plant.
   Group 3: Prepares information and materials on a secondary treatment plant.
   Group 4: Prepares information and materials on how a septic system works.

SUMMARY

1. Each group presents its information to the class.
2. List advantages and disadvantages of each form of treatment.
3. Arrange a classroom display using the information presented.

WASTE WATER SYSTEM - OR WHERE IS "DOWN THE DRAIN"?

DIGEST

I. PREPARATION

Materials needed:

Diagrams of where the waste water from the school goes - probably obtained from maintenence department or Public Works Dept., City and County Wastewater Mgt. Div.

Diagrams or pictures showing types of sewage treatment facilities used for the school's waste water.

VOCABULARY

primary treatment
secondary treatment
septic tank
cistern

II. STUDENT ACTIVITIES

Question: What happens to water after we use it; or where is "down the drain"?

1. Discuss with students where they think the waste water from the school goes - list options.
2. Divide the class into groups
   - Group 1: Finds out where the waste water from the school goes and what sort of treatment the school waste water undergoes.
   - Group 2: Prepares for a class presentation on what a primary treatment facility does to the waste water. Include advantages and disadvantages.
3. Organize into groups and each group should design and build a model of water distribution system or make a large scale drawing to be put on the bulletin board. Within each group the following tasks need to be done:
   - Task 1 - design the system to be built
   - Task 2 - collect materials needed for the building - cardboard cylinders, PVC pipe (if possible), garden hose etc. anything that could be used
   - Task 3 - clear out a work area for the model or if it's to be a drawing make space available on the bulletin board
   - Task 4 - make a list of the terms used in the distribution, purification process with their meanings to be displayed with the model
   - Task 5 - build the model

III. SUMMARY

1. Display model systems.
2. Discuss the water purification system in more detail.
3. Look into alternate water collection and distribution systems -
   - well water
   - artesian well
   - cistern

WASTE WATER SYSTEM - OR WHERE IS "DOWN THE DRAIN"?

NOTES

A commonly used expression is "it's money down the drain". Well, just what does that mean - where is "down the drain?" Most of the water used at school and home is for caring of wastes. Drinking, cooking and even lawn watering, accounts for less water than is used for washing babies and clothes, flushing the toilet, running the disposal in the sink, etc.

Most waste water is generally carried from homes and school in the sewer system located under the streets. This sewer network looks like a web of stream channels. Sewer pipes increase in size as more pipes join, like a river increases as it flows downstream. The whole system may end up at:

1) a primary sewage treatment plant where it will be mostly purified by a series of filters, a settling tank, and then chlorinated and dumped into a stream or other body of water.

2) a secondary treatment plant where even more possible pollutants are removed by use of microbes which can break down the organic matter and then it's dumped into a river or other body of water.

3) in some rare cases the waste water might be directly pumped into the ocean.

Encourage students to make drawings and diagrams for their class presentations.

Section 4

Purification

Instructional Goals

When faced with decisions concerning the use of terrestrial and extraterrestial resources, students will select practices developed in recognition of present future environmental and human needs.

Instructional Objectives

Discuss the concept that the Earth is a spaceship with limited resources and has a limited capacity for recycling. Sc, SS, H, N

Develop a model to demonstrate how water can be recycle. Sc, SS, H

Write an imaginative story about a drop of water's journey through the water cycle. Sc, LA, H

Estimate the cost of water one uses per year if water costs 77¢ per 1,000 gallons.* M

*Price data current as of November 1, 1980.

Cite examples illustrating how water management and conservation practices have affected the usefulness of land. SS, Sc

Identify individual and community practices that affect quality of both fresh and marine water resources. Sc, SS, H

Illustrate how delay increases the cost of cleaning up water. SS, M

Performance Expectations

Conducts simple investigations to gain first-hand information on environmental matters.

Cites examples of occupations that are primarily concerned with the study or control of specific environments.

Describes the impact of various industries on the environment.

Identifies state and federal government agencies primarily concerned with environmental management or control.

Communicates feelings evoked by various types of environments.

Cites examples of negative and positive ways human beings can change the environment.

Essential Competencies

Use computational skills in situations common to everyday life.

Read and use scales on standard measuring devices.

Reach reasoned solutions to commonly encountered problems.

Identify the training, skill and background requirements of at least one occupation in which the student is interested.

Demonstrate knowledge of the basic structure and functions of national, state and local governments.

Section Objectives

Identify natural methods of purification including evaporation, percolation, and aeration.

Develop skills of experimental design and execution.

Develop measurement and computation skills.

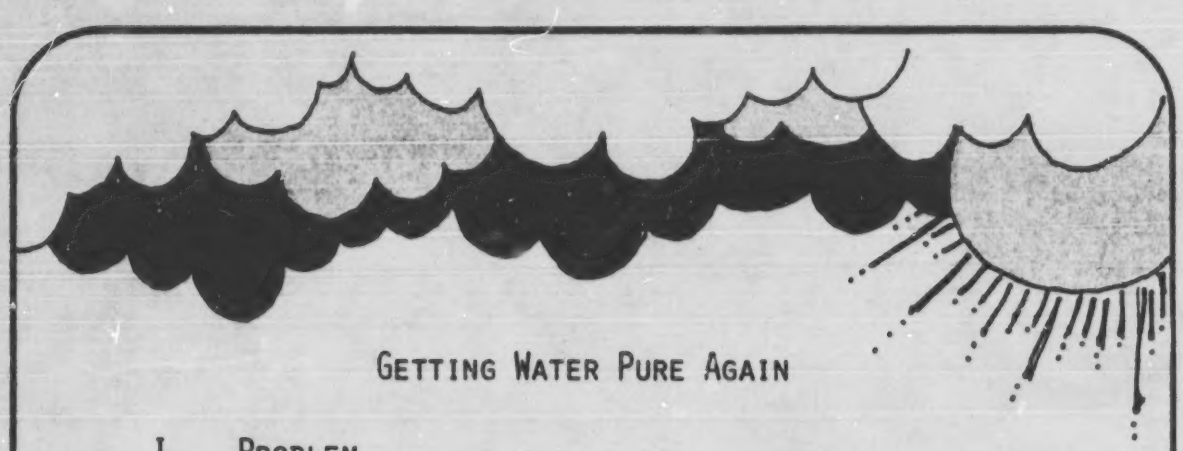
Identify and describe the biological and chemical processes used in sewage treatment plants.

Identify the volume of sewage produced by urban populations and the necessity for sewage treatment to recycle water.

Describe desalination processes and establish the relatively high economic cost.

Identify and describe the role of the Department of Public Works and related personnel.

Develop skills of creative expression through oral, written and artistic communication.



GETTING WATER PURE AGAIN

I. PROBLEM

How is water purified?

II. DISCUSSION

Some people have the mistaken idea that when we use water it is destroyed and disappears forever. But water never wears out. We still have the same amount of water on Earth as we have ever had.

The water is not always clean though. For example, water that goes into our sewer system is unfit to drink. How is water purified in nature? Can you make an unpure sample of water pure again?

WHAT YOU WILL NEED

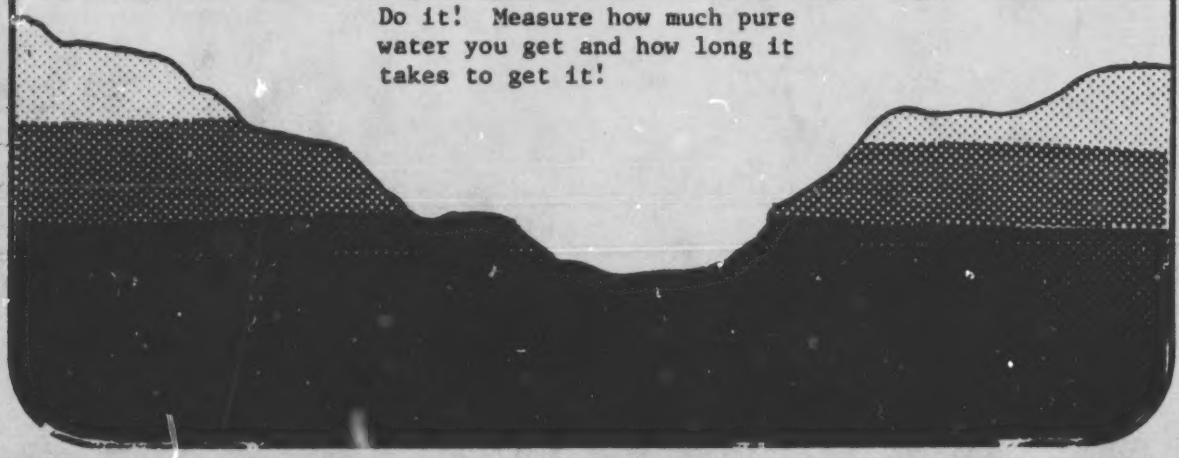
- a sample of unpure water
- a partner to work with

WHAT TO DO

Invent a way to purify your sample of contaminated water. Use only methods that could occur in nature.

Make your plans.

Do it! Measure how much pure water you get and how long it takes to get it!



SHARING THE RESULTS

Describe to the class how you purified your water sample. Tell how much water you got. How long did it take? Make a graph of water quantity versus time.

Make a list of the different ways water can be purified naturally.

QUESTIONS TO ASK

Is your sample really pure? What is meant by "pure"?

Would you drink your "pure" sample? Why or why not?

ADDITIONAL ACTIVITIES

Is your "pure" water good for plants?

Design an experiment to find out. Use tap water on some plants and your pure water on some others. How will you know if the water makes a difference?

Which purification method(s) would be useful to recycle water in a sewage treatment plant?

GETTING WATER PURE AGAIN

DIGEST

I. PREPARATION

Prepare dirty water samples.

Prepare salt water samples.

Collect materials for experiment.

VOCABULARY

distillation
filtration
pure
solar still

II. STUDENT ACTIVITIES

Problem: How is water purified?

Show samples of dirty water.

List possible ways to purify samples.

Design experiments. Check for safety.

Carry out the experiments.

Measure the amount of water collected.

Measure the time of collection.

III. SUMMARY

Water can be cleaned or purified by various methods including distillation and filtration.

Water samples which look clean may not be pure.

Water can be purified naturally. Natural processes can also be speeded up by humans.

GETTING WATER PURE AGAIN
NOTES

I. PREPARATION

Prepare samples of unpure water for each group of students. For this activity groups of 2-4 students are most appropriate. The samples can be prepared by mixing some soil in water or add substances like coffee creamer, nutmeg, or similar to water samples. The samples can be placed in baby food jars or similar containers. Samples of about 100 ml per group are sufficient for this activity.

Prepare at least one or two samples of salt water. Sea water may be used if available. This will prepare the class for later discussion of desalination of water.

Materials needed in addition to the water samples are difficult to predict since students are asked to invent their own methods of water purification. A probable list of class supplies is shown below. Students can be asked to supply most of the needed materials

jars of various sizes
sand and gravel
heat source (candle, alcohol lamp etc.)
aluminum foil
test tubes
test tube clamps
clear plastic wrap
tin cans of various sizes
rubber bands

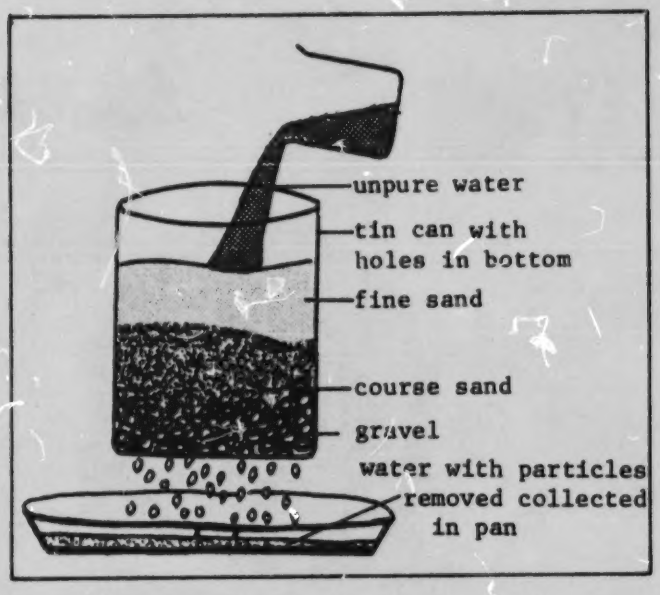
II. STUDENT ACTIVITIES

To introduce the activity hold up samples of the unpure water. Ask if these look like drinkable samples. Point out that sometimes water gets contaminated through natural processes such as run off or through use of the water in homes and industry. Ask the class to list the ways that water can be purified once more. List the student suggestions on the board or overhead projector. Accept any methods students suggest.

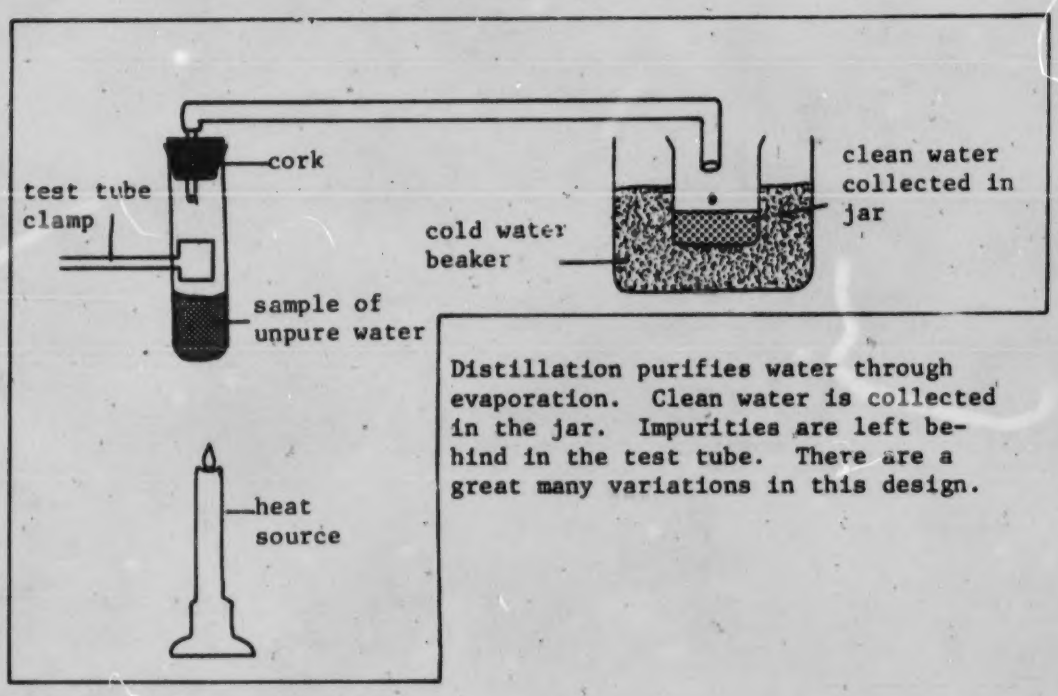
Divide the class into groups of 2-4 students each. Have them follow the directions on the Task Card. Several possible methods of purification are shown below. Students will surely invent additional methods.

Filtration

Filtration purifies water by removing particles suspended in the water as it passes through the sand and gravel. This is a natural water purification method commonly found in streams and watershed areas. (Filtration may not always completely purify water.)

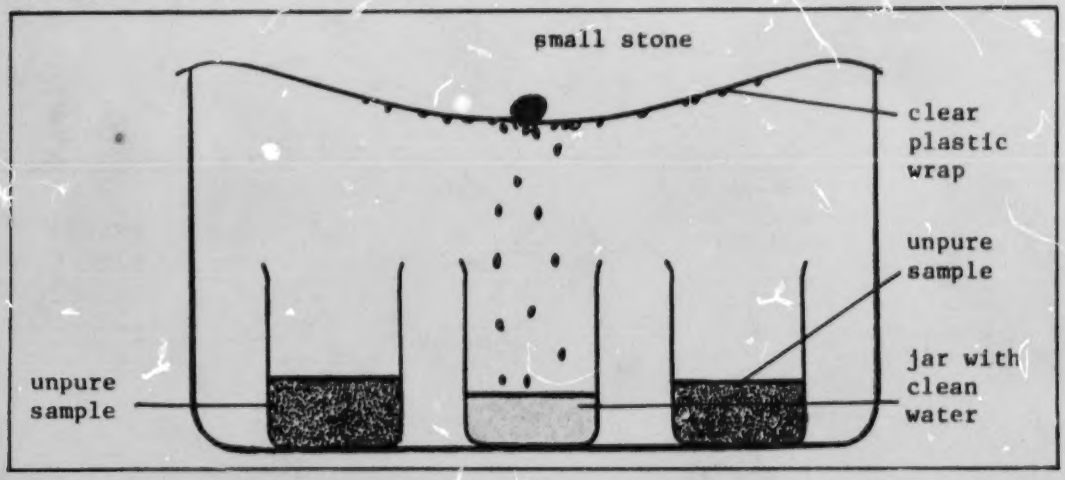


Distillation



Distillation purifies water through evaporation. Clean water is collected in the jar. Impurities are left behind in the test tube. There are a great many variations in this design.

SOLAR STILL



The solar still uses the sun's energy to evaporate water. This is a common survival technique in dry areas of the world. Cover a jar, can, or terrarium with clear plastic wrap. Place a small stone on top to make a depression in the plastic covering. Place the still in sunlight. Water evaporated from the unpure sample will collect on the plastic wrap and run down to the lowest point of the depression made by the small stone. By placing a jar under the depression, clean water can be collected as it drips off the plastic wrap. There are many variations of this design.

Students can measure the amount of pure water collected (in milliliters, inches in jar, etc.) and the time needed to collect the pure water. They can then graph their data.

ADDITIONAL ACTIVITIES

Students are asked to design an experiment to test the effect of their purified water on plants. A possible experimental design is shown below.

Control - Tap Water

Experimental - "Pure Water"

1. Select eight plants all of the same age or plant seeds to grow eight new plants.

2. Place the plants in the same amount and type of soil.

3. Place the eight plants where they will all receive the same environmental exposure.

4. Water the plants regularly. Water 4 with tap water; water 4 with "purified" water. Be sure the plants get the same amount of water at approximately the same time.

5. Measure and record results on growth, color, general health, etc.

SPEEDING UP THE PROCESS

I. QUESTION

What methods do people use to recycle water?

II. DISCUSSION

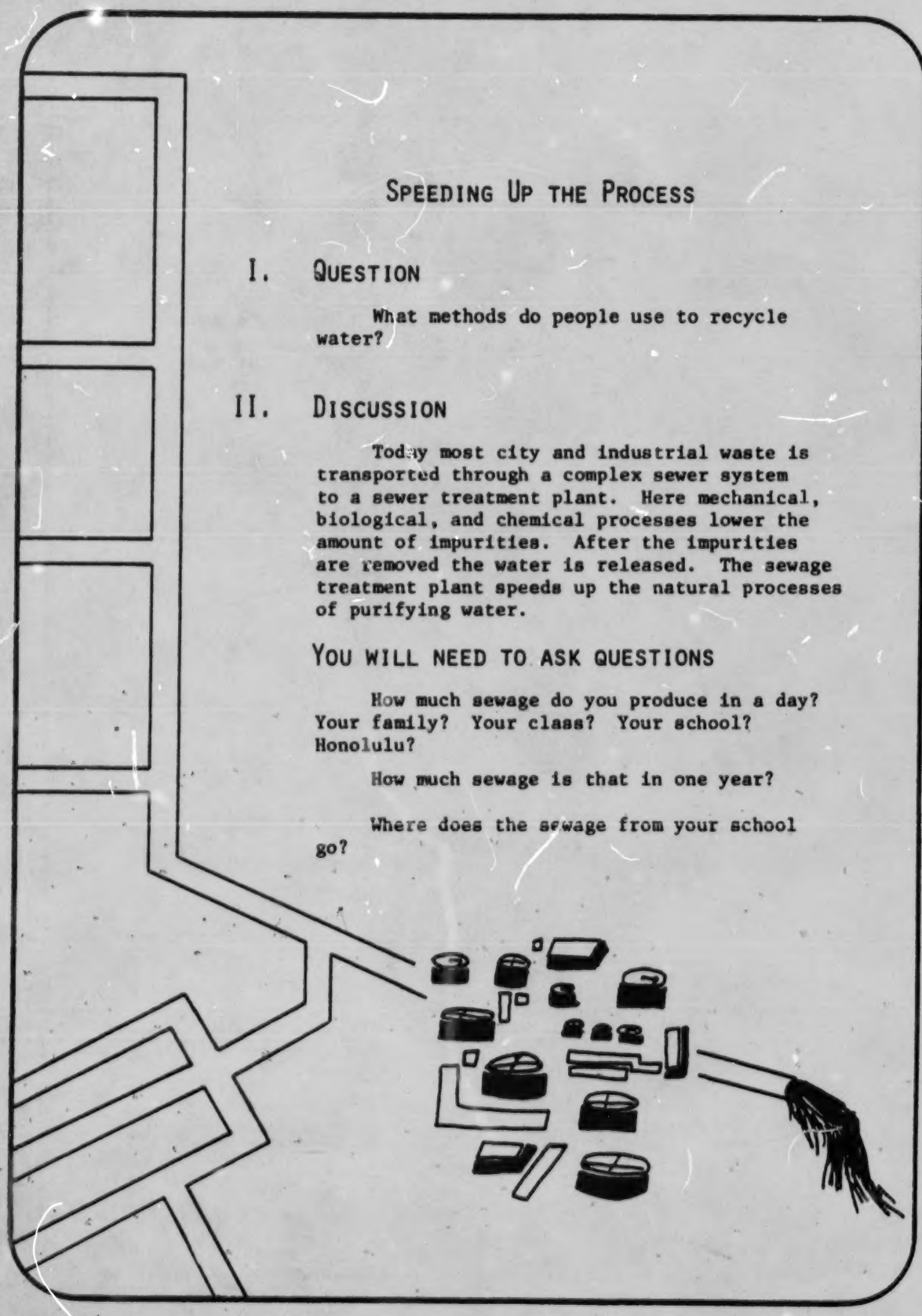
Today most city and industrial waste is transported through a complex sewer system to a sewer treatment plant. Here mechanical, biological, and chemical processes lower the amount of impurities. After the impurities are removed the water is released. The sewage treatment plant speeds up the natural processes of purifying water.

YOU WILL NEED TO ASK QUESTIONS

How much sewage do you produce in a day? Your family? Your class? Your school? Honolulu?

How much sewage is that in one year?

Where does the sewage from your school go?



What kind of sewage plant do you have in your community? What happens to your sewage?

How much does the sewage treatment plant cost to operate? How much does it cost you to operate it?

Where does the treated water go?

HOW TO DO IT

The average person uses about 150 gallons of water per day and produces about 120 gallons of sewage per day. Use this information to calculate how much sewage is produced in your community?

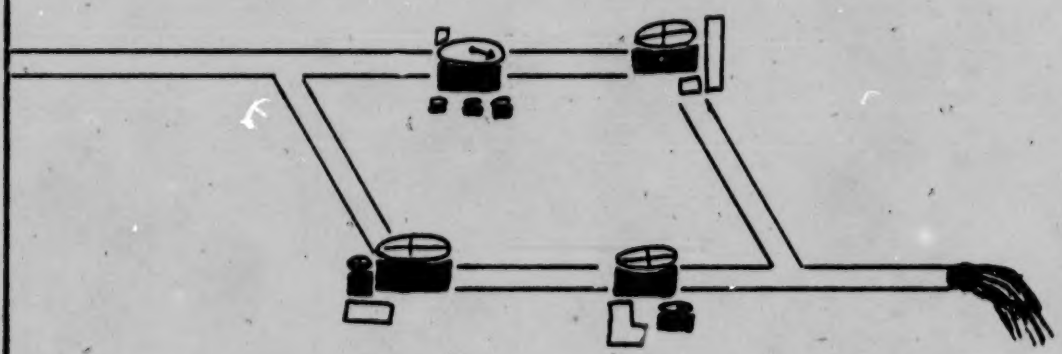
Find out what agency controls the sewers and sewage treatment plant in your community.

Ask them for the information you need.

SHARING THE RESULTS

Make a sketch of the sewage treatment plant in your community. Show which processes are used to purify the water. Show what happens to the treated water.

What is meant by primary, secondary and tertiary treatment?



Speeding Up the Process

Digest

I. Preparation

Prepare transparencies.

Arrange for slide/tape presentation of Department of Public Works.

Gather information about local sewage treatment plants.

Vocabulary

primary
secondary
tertiary
effluent
sludge
trickling filter

II. Student Activity

Question: What methods do people use to recycle water?

Calculate how much sewage is produced.

Find out where the sewage goes, Department of Public Works Wastewater Management Division, 523-4429.

Find out how the sewage is treated.

III. Summary

Make a sketch or model to show where the sewage goes and what happens to it.

Sewage treatment plant speeds up the process of cleaning the water.

Speeding Up the Process

Notes

I. Preparation

The following transparencies should be prepared for this activity. Transparency masters are provided on the following pages
- stages of sewage treatment
- septic tank operation

A 10 minute slide/tape presentation is available from the Department of Public Works, City & County of Honolulu on clean water and pollution. A short quiz is also provided.

The Environmental Protection Agency also publishes a Primer on Wastewater Treatment. This booklet contains colorful pictures and explanation of sewage treatment methods. Copies are available from:

Environmental Protection Agency
Office of Public Affairs (A-107)
Washington, D.C. 20460

II. Student Activities

Have students recall their experiments with purification of water. Ask what happens to water that they use or dirty in their activities. Discuss with students where they think the sewage water goes. List their ideas on the board. There are several different things to do in this activity. You may wish to group students and share the responsibilities. Groups can then share their findings at the end of the activity.

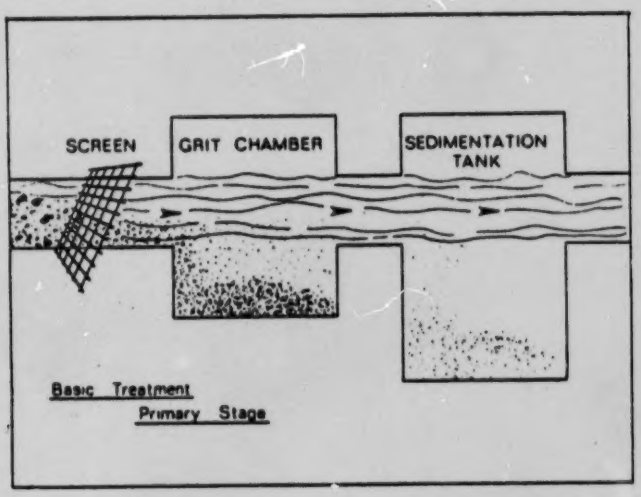
Have students calculate how much sewage is produced each day by their own family, their school and their community. Calculate the amount of sewage produced on Oahu assuming a population of 800,000 people. The average person produces about 120 gallons of sewage each day.

Depending upon where the community is located the sewage of the school will go to different places. The Department of Public Works, Wastewater Management Division of the City and County of Honolulu, is responsible for sewage treatment on Oahu. There are sewage treatment plants at Ala Moana, Kailua, Kaneohe, Makakilo, Pearl City, Wahiawa, and Waianae. The Department of Public Works can be called for information on which plant receives the school sewage and what water treatments are provided at the plant. A field trip to the local sewage treatment plant may also be arranged. See Student Activity 4.4.

Sewage Treatment plants in Hawaii following EPA regulations use primary, secondary, and tertiary stages of sewage treatment before releasing the water back into the environment.

Primary Treatment

As sewage enters a plant for treatment it flows through a screen which removes large objects that may clog pumps. Some plants use a device called a comminutor which screens out large objects, then grinds them up. After the sewage is screened it passes into a grit chamber where sand, grit, cinders and small stones settle out. This unwanted sand and gravel is often used for landfill. The sewage then passes into a sedimentation tank where finer particles are allowed to settle out.

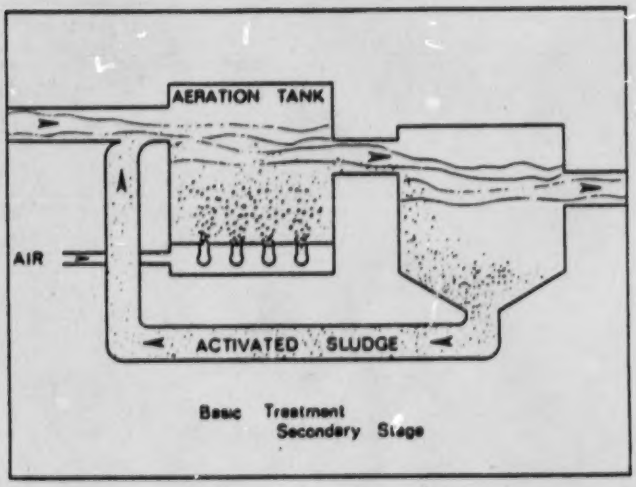


Secondary Treatment

The secondary stage of treatment removes up to 90% of the organic matter in sewage allowing bacteria to decompose it into harmless substances. This is done in one of two ways, by using a trickling filter or an activated sludge process.

A trickling filter is simply a bed of stones from three to six feet deep through which the sewage passes. Bacteria gathered on the stones consume most of the organic matter in the sewage. Cleaner water trickles through pipes in the bottom of the filter.

A more common technique used today is the activated sludge process because it speeds up the process of decomposition by pumping air into the sewage. The additional air enables bacteria and other tiny organisms to grow and reproduce rapidly, resulting in a faster decomposition of sewage.



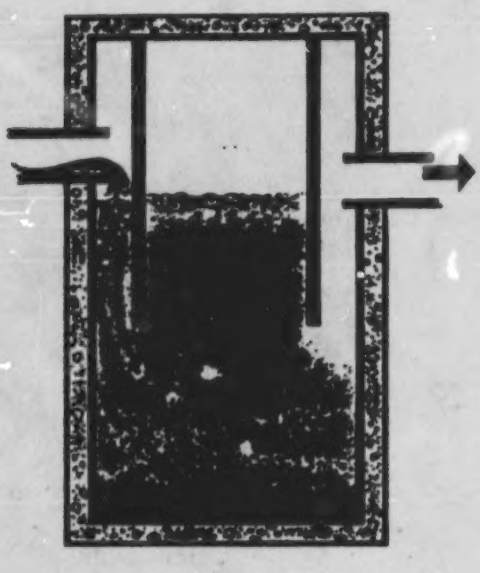
The activated sludge process requires less land space than the trickling filter and is free of flies and odors but is more costly to operate.

Tertiary Treatment

Some cities have installed tertiary sewage treatment before releasing water back into the environment. Tertiary treatment involves quite sophisticated processes including the use of absorbents, chemical exchange, reverse osmosis and ozone treatment. These processes remove chemicals which got into the water from the use of pesticides, fertilizers and other industrial products. The water, then called effluent, is released back into a stream or into the ocean.

Septic Tank

In rural areas where no community sewage system exists a septic tank is usually buried in the ground to treat the household sewage. Waste water from the home flows into the tank where bacteria in the sewage breaks down organic matter. Cleaner water flows out of the tank into the ground through subsurface drains. The sludge in the bottom of the septic tank must be periodically cleaned.

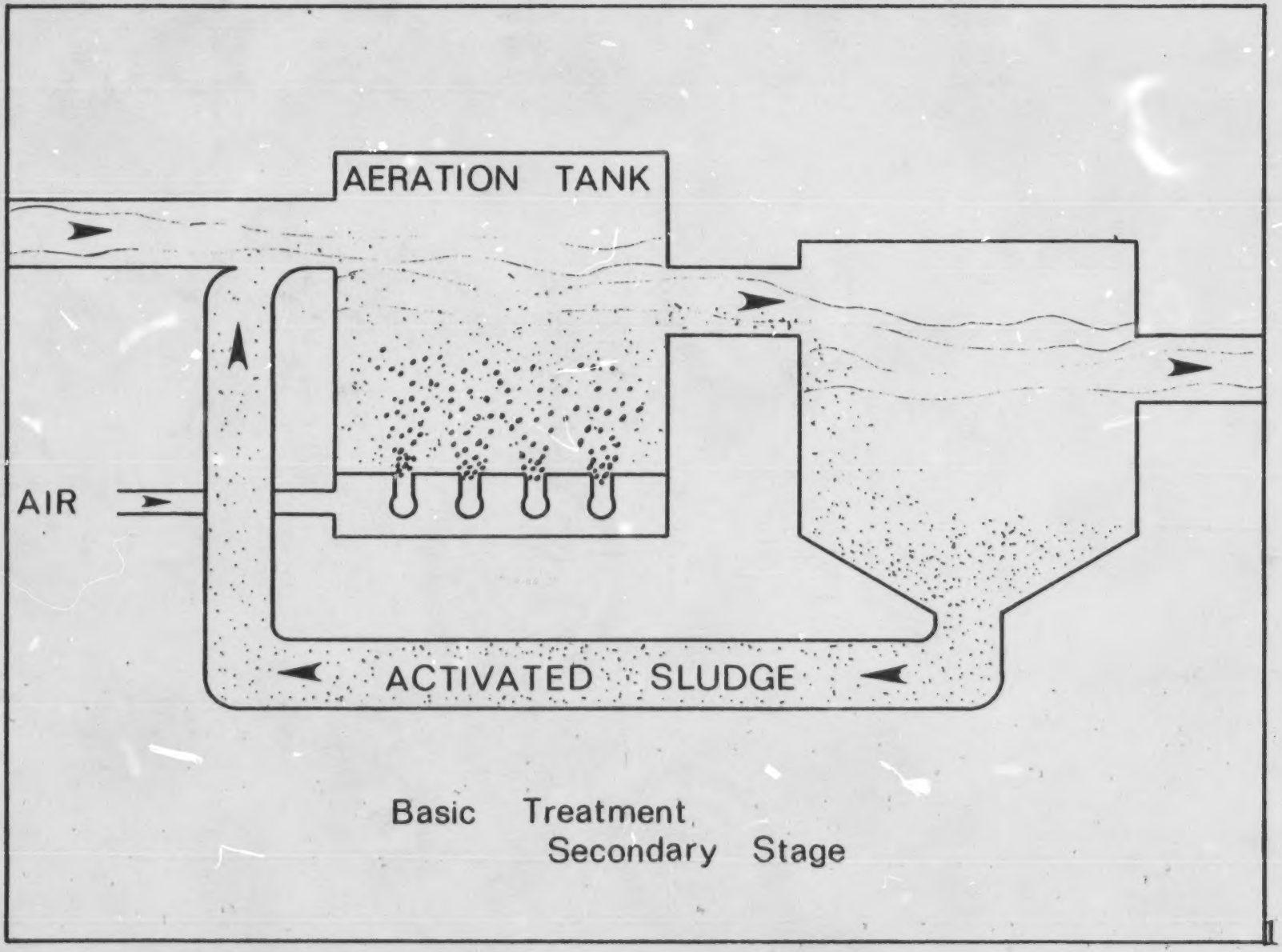


III. Summary

Have students make a sketch or model on the bulletin board of the general operations of the sewage treatment plant. Have them show sewage inflow, primary, secondary and tertiary treatments, and the effluent. Wherever possible have them identify the system used in the plant which treats their sewage. Allow students to be creative in designing their sketches or booklets.

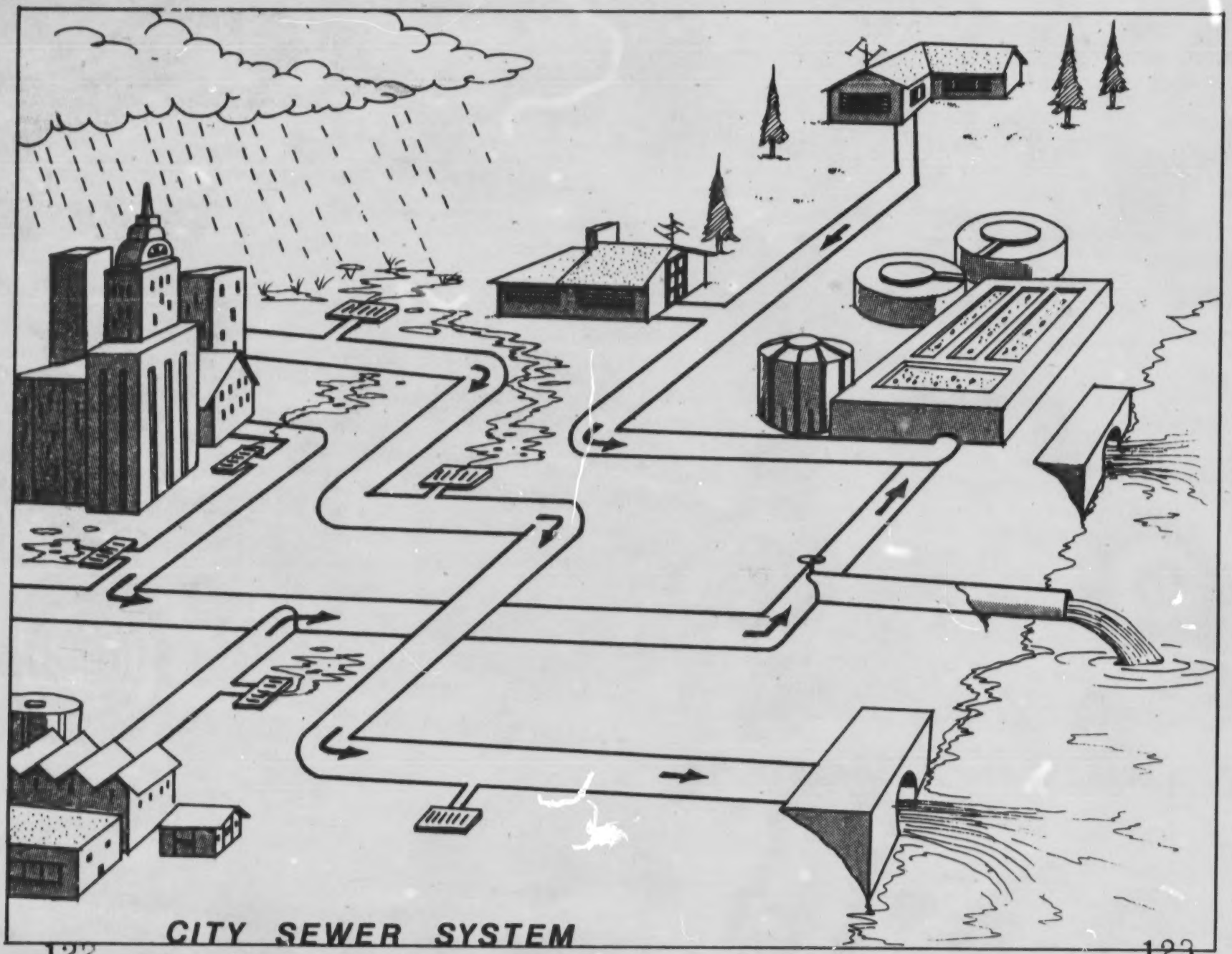
Point out that the sewage treatment plant uses natural processes to clean the water. In the sewage treatment plant the processes are greatly speeded up through technology.

T 4.2



E18

Basic Treatment
Secondary Stage

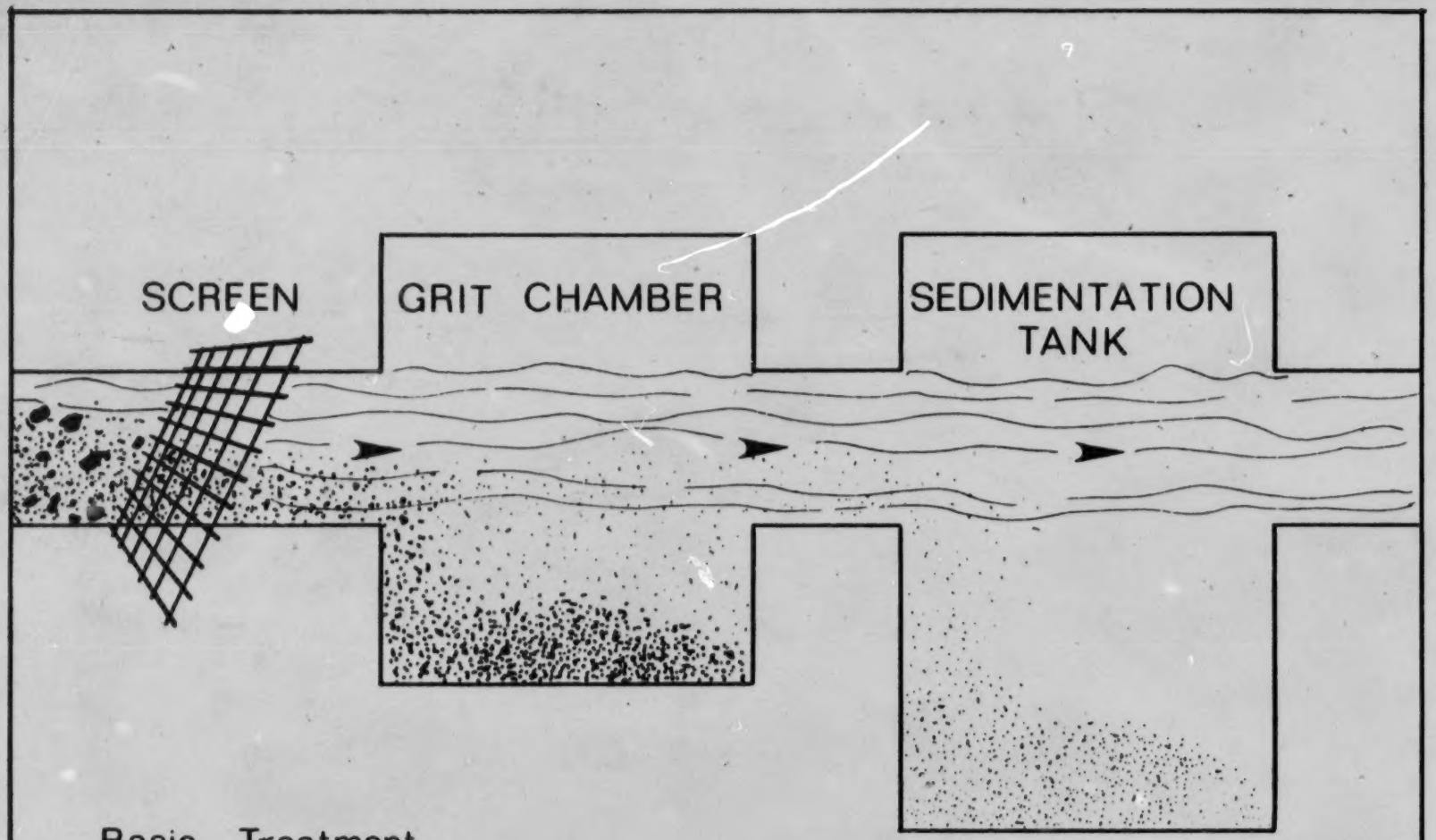


CITY SEWER SYSTEM

E19

T 4.2

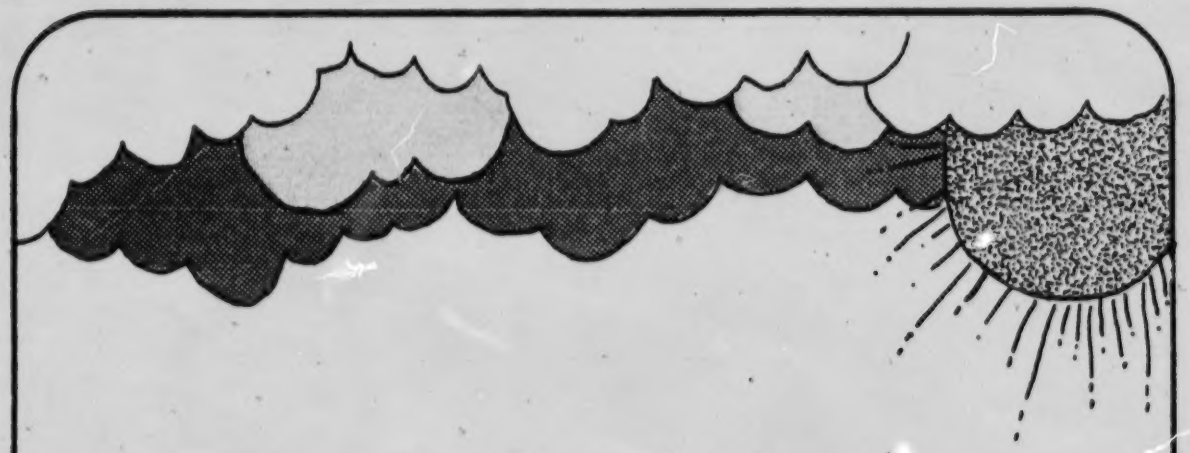
T 4.2



E20

Basic Treatment

Primary Stage



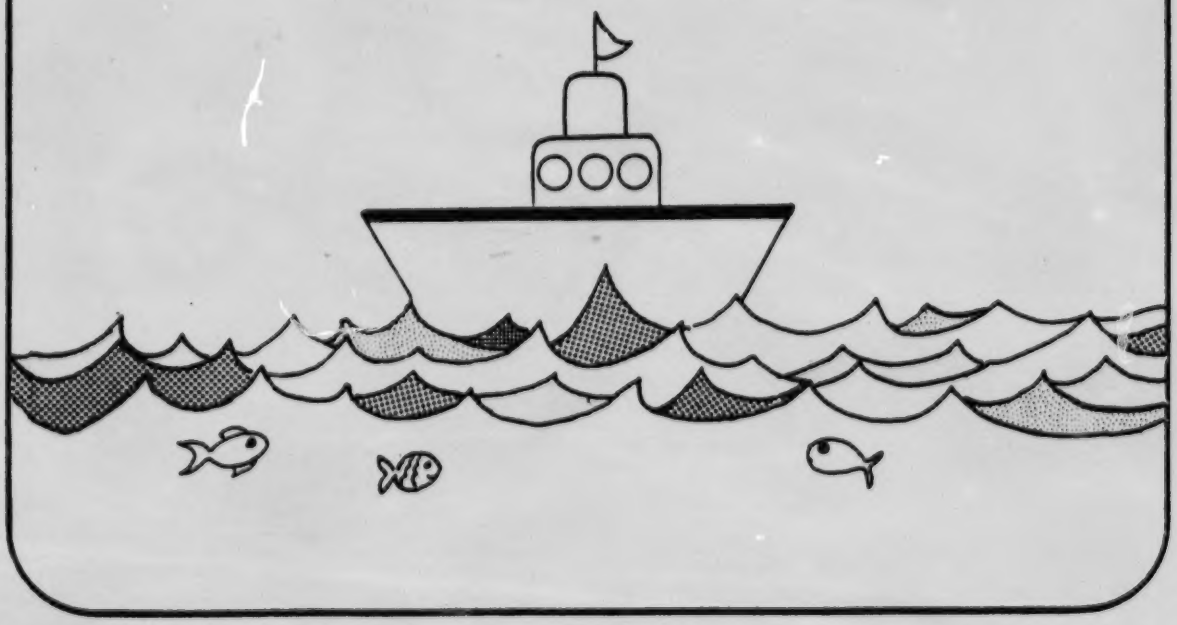
WATER FROM THE SEA

QUESTION

Why don't we use sea water?

DISCUSSION

Hawaii is surrounded by ocean. Changing salt water into fresh water is called desalination. Why don't we get our pure water from the ocean?



QUESTIONS TO ASK

How can we get fresh water from sea water? Can you demonstrate a process?

Do other places get their water from sea water? Which places?

Why doesn't Hawaii use ocean water to get fresh water?

HOW TO FIND OUT

Demonstrate how to desalinate water. How much does it cost in time? In money? In energy?

Find out how much desalination costs per 1000 gallons.

Find out how much 1000 gallons of water currently costs from the Board of Water Supply.

HOW WILL YOU TELL THE STORY?

Write a story describing a community that uses desalination to get their fresh water. Be sure to tell what the environment of the community is like and why they use desalination instead of other ways to get water.

WATER FROM THE SEA

DIGEST

I. PREPARATION

Obtain some sea water.

Collect flasks, stoppers, hot plates for desalination.

VOCABULARY

desalination
distillation

II. STUDENT ACTIVITIES

Question: Why don't we use sea water?

Distill some sea water.

Discuss desalination.

Note its high cost.

III. SUMMARY

Write a story about a community that uses desalination to get its water.

WATER FROM THE SEA

NOTES

I. PREPARATION

This is an optional activity. Desalination can be used to obtain potable water from brackish water or ocean water.

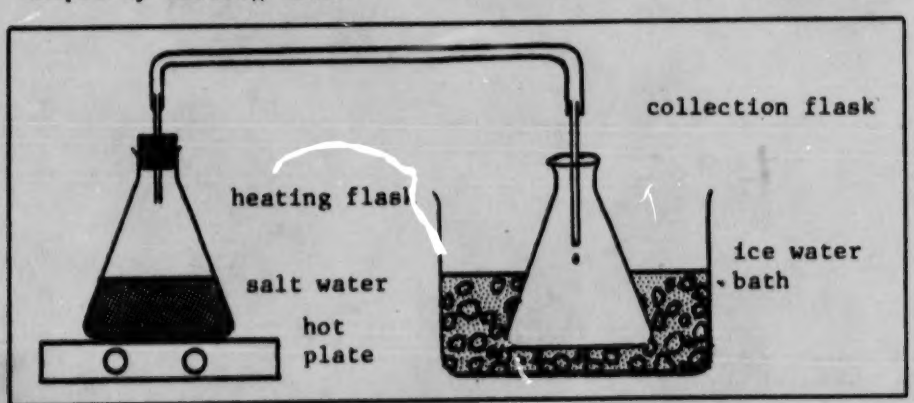
- 2 flasks, 250 ml
- heat source; candle, hot plate, etc.
- stopper, one hole to fit flask
- glass tubing
- salt water
- rubber tubing

II. STUDENT ACTIVITIES

An island state surrounded by water would seemingly never have to worry about a water supply. However as most students are very much aware, the ocean water is undrinkable.

The salt can be removed by desalination, a distillation process that some students may have employed in Activity 4.1. Desalination is very expensive to use in terms of energy and machinery costs to provide fresh water. Only in places where other alternatives are not available is desalination a viable method of obtaining fresh water. Places such as Israel have turned to desalination to provide some of its water needs, but the costs are high. Currently the Board of Water Supply in Honolulu charges about 77¢/1000 gallons* While desalination of sea water would cost about $3.00/1000 gallons.

Demonstrate, or have students demonstrate the desalination of sea water. A simple apparatus is shown below. Have students measure the length of time taken to distill the water, and the quantity of water obtained. Students can compare the water sample by tasting each.



*Current as of November, 1980.

III. Summary

Some communities must use desalination, particularly some arid places in Israel, some island communities, etc. Encourage students to be creative in imagining and writing about such a community. Have them focus particularly on what the environment of the community is like. Point out that under certain circumstances desalination is a reasonable alternative for obtaining fresh water.

GETTING THE INFORMATION STRAIGHT

I. ACTIVITY

Visit a sewage treatment plant.

II. DISCUSSION

Many of us do not think about the water we use, especially after it goes down the drain. Some people in the community earn their living by providing water and sewer service. What do such systems look like? Who are the people who provide such services?

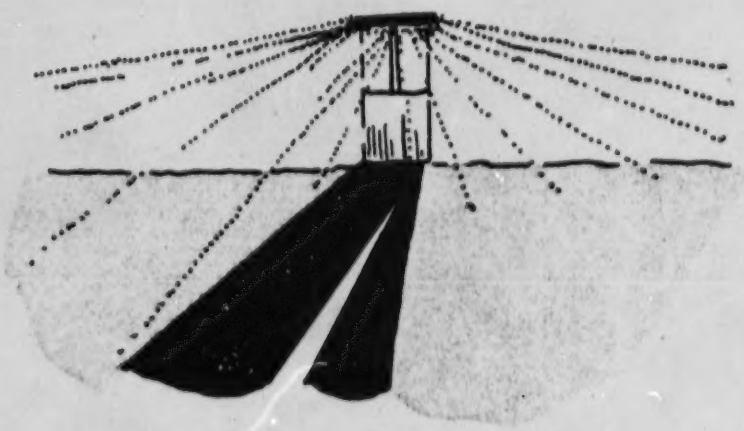
WHERE TO GO

Arrange a field trip to the local sewage treatment plant.

WHAT TO DO

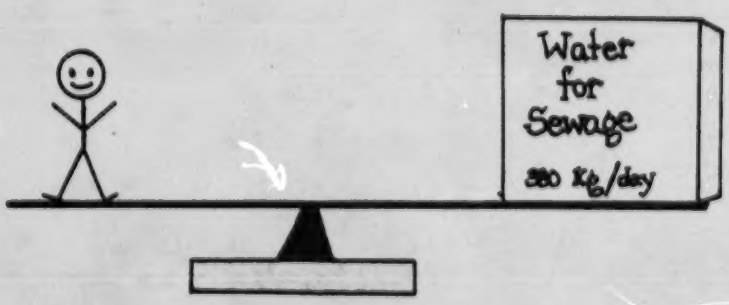
Identify the different parts of the system. Find out what the following are:

screening	primary clarifier
grinding, comminution	trickling filter
pumping	final clarifier
	sludge



One hundred gallons of sewage per person per day. One gallon is 3.785 liters. Density of sewage is about that of water. Then, you produce about 380 kg of sewage per day. If you weigh 60 kg, how many times your weight is 380 kg?

(1 liter of water $\approx$ 1 kg.)



GETTING THE INFORMATION STRAIGHT

DIGEST

I. PREPARATION

Arrange a field trip to the local sewage treatment plant.

VOCABULARY

screening
shredding
comminution
Parshall flume
trickling filter

II. STUDENT ACTIVITIES

Activity: Visit a sewage treatment plant.

Prepare to ask questions about the types of treatment used, where the effluent goes. Identify the different parts of the Plant.

III. SUMMARY

Add the information gathered on the field trip to the sketch or model of the sewage treatment plant made in Activity 4.2. Make any necessary changes.

THE PERSON FROM THE SEWERS

I. ACTIVITY

Invite a guest speaker from the Department of Public Works to explain the sewer system and the sewage treatment plant.

YOU WILL NEED TO ASK QUESTIONS

Find out what the words you don't know mean.

What does the Department of Public Works do?

Find out what primary, secondary and tertiary treatment are.

Find out what happens to the effluent from the plant.

ASK THE SPECIALIST:

Why did you decide to do this kind of work?

How did you prepare for the job?

What do you do?

What are the problems of doing your job?

Prepare questions of your own. Decide who will ask the questions.

SUMMARY

Write a story describing the life of several raindrops from the time they fall to the ground to your house, and back to the air again. Identify as many different life stories as you can.

The Person From Sewers

I. Preparation

Call the Department of Public Works and invite a speaker to talk on the Department and its responsibilities, the waste water management Division, and particularly Sewage Treatment.

II. Student Activities

Activity: Invite a guest speaker.

Have students prepare questions for the speaker to answer. Be sure they know who will ask the questions.

Make the introductions and allow the class to interact with the speaker. Set a time limit if you must.

III. Summary

After the speaker leaves discuss the presentation. Were all the questions answered? Do students know generally about the role and importance of the Department of Public Works?

This is the last activity in Section 4. It's a good time to summarize. Have students write about the alternative pathways water can take through the environment. Encourage students to share stories.

Section 5

Water Issues

Instructional Goals

When faced with decisions concerning the use of terrestrial and estraterrestrial resources, students will select practices developed in recognition of present and future environmental and human needs.

Students wiill demonstrate their awarencess and knowledge of population processes and dynamics.

Students will examine optional courses of action and their consequence for improving the quality of life and will support those that will provide optimum short-and long-term benefits for society and the environment.

Instructional Objectives

Locate resources in the neighborhood, community and country which are undergoing change. Sc, SS, H, HS, LS

Identify problems involving soil, water, air and plant life in the community and suggest and defend possible solutions to the problems. Sc, SS, H, N

Describe some aspect of life in Hawaii that has changed in the last two hundred years and relate this change to population changes. SS, LA, HS, C

Observe and identify types of pollution that affect the quality of life. Sc, SS, H, Art, Music, N

Give examples of steps which might be taken to prevent or minimize pollution by some of the following: self, family, neighborhood, industru, towns, cities, countries, states, federal government, United Nations, nations of the world. Sc, SS, H, C, V

Survey the community to determine attitudes of individuals, farmers, businesspersons or others about pollution control. SS, H, Sc, C, V

Discuss reasons why laws have been established to reduce pollution, protect wildlife, protect plants, or protect the environment in some way. H, SS, Sc, V

Explain how the uneven distribution of natural resources affects the citizens of various countries including the United States. SS, M, C

Sugget political, social and economic reasons for proposing laws about use of natural resources. Sc, SS, H, C

Design a dramatic production to illustrate the dependence of plants and animals upon water as a resource. Sc, LA, N

Cite examples illustrating how water management and conservation practices have affected the usefulness of land. SS, Sc

Identify individual and community practices that affect quality of both fresh and marine water resources. Sc, SS, H

Illustrate how delay increases the cost of cleaning up water. SS, M

Discuss whether new laws, a concerned citizenry and new technology will enable humans to maintain a livable environment. H, SS, Sc, V

Performance Expectations

Identifies causes of local environmental problems.

Uses a variety of resources to gain information on environmental matters.

Explains the effects of environmental changes on recreational opportunities.

Describes the impact of various industries on the environment.

Describes the natural resources needed by various industries and relates the locations of those industries to available resources.

Explain the need for rules to protect the environment.

Identifies state or federal government agencies primarily concerned with environmental management or control.

Lists a number of environmental factors which may affect the emotional or physical health of human beings.

Cites examples of negative and positive ways human beings can change the environment.

Identifies and describes environmental factors which influence the beliefs of different cultures.

Identifies specific contributions one can make to help human beings live in harmony with the environment.

Describes the effects of environmental changes on the beauty of an environment.

Explains how environmental factors such as noise level or air quality may affect the emotional and physical health of human beings.

Identifies non-governmental groups primarily concerned with environmental matters.

Essential Competencies

Read and use printed materials from daily life.

Demonstrate writing skills common used in daily life.

Reach reasoned solutions to commonly encountered problems.

Distinguish fact from opinion in TV and radio news broadcasts, advertizing, newspaper and magazine articles, and public speeches.

Use resources for independent learning.

Demonstrate knowledge of the basic structure and functions of national, state and local governments.

Demonstrate knowledge of important citizen rights and responsibilities.

Section Objectives

Identify problems/conflicts/issues related to water.

Communicate findings acquired through research.

Use current event articles as a source of information.

Practice classification skills.

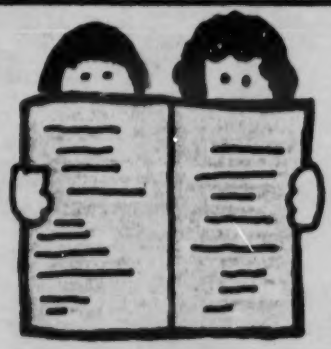
Use art as a means of communication.

Use drama as a means of communication.

Practice research skills.

Graph and visually represent data.

Use and construct maps as information sources.



Is There a Problem?

I. Observation

Water is a topic that frequently comes up in the newspapers. What are the ways in which water is mentioned?

II. Discussion

You have learned many interesting things about water. All the water that we will ever have is located somewhere within the water cycle. Water is a very essential, vital resource. Many people need clean water to use for a variety of different things.

Activities

Included with this activity are several newspaper articles written about water. Read these articles to determine:

1. a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of the water, etc.?
   b) What is the position or opinion of the person who wrote the article?
   c) Are several opinions expressed?
   d) Is a conflict mentioned either directly or indirectly? What is it?

2. Either by yourself or with one or two others, go through the newspaper articles you have, compare them with issues that may be mentioned in your science and social studies books, and make categories of water issues. Does a problem emerge?

HOW TO TELL ABOUT IT

Choose one or more of the following ways to share what you have found out with the others in your class:

1. On a large sheet of butcher paper, list findings or problems that were mentioned in the news article - list yours in the space set aside for your group. Be prepared to discuss the issues or problems you found.

2. Think about the problems. Who expressed the problems? Think how that person or group of people might be represented in a drawing. (Example: a person with a rake to show farming; a person with a fishing pole to show fishing; a person standing in a cane field to represent sugar growers; etc.) Now in a cartoon fashion, draw a person and show what he or she might say. Put the words in a "balloon" coming from his/her mouth.

3. Write a short summary of the article - only the main ideas. Then with a small group think how you could "act out" the article. Prepare a short skit to present to the class. You might want to make name signs (farmer, fisherperson, homeowner, tourist, etc.) for the players. If you can find any music that would provide good background music for your situation, include it.

Is There a Problem

Digest

I. Preparation

copies of newspaper articles (Sample articles are supplied.) large sheet of butcher paper class organized into groups, if desired

Vocabulary

opinion
conflict

II. Student Activities

1. Students will read the newspaper articles to identify particular issues related to water.

2. Students will relate issues mentioned in news articles to issues mentioned in social studies or other texts.

By listing on butcher paper, illustrating in cartoon fashion, or presenting a summary skit, students will share what they learned from the water-oriented newspaper articles.

III. Summary

This lesson emphasizes the current state-wide concerns with water issues.

Is there a Problem?

Notes

Dividing the class into groups might provide a solution to reading problems in working with the news articles. If possible, each group should have one or more capable readers.

An alternative to class or group reading of the articles would be for the teacher to briefly outline or summarize the articles and discuss the issues with the total class. This approach is advisable if the teacher feels that individually the students might not be able to single out the main points in the articles.

The answers to questions asked in the activities section are given.

Planning ahead: It is preferable for all students to do each activity. card. However, if limited time is a problem, for the remaining activities in Section 5, the class may be divided into groups with separate groups assigned activities 5.2, 5.3, 5.4, and 5.5. After completing the activities, individual groups can then share their finding with the rest of the class.

A Particular Point of View

Honolulu Is Not San Francisco

By Harlan G. Koch

ALTHOUGH WE MIGHT not always agree with ladies' clubs, I believe their efforts deserve better than architect George Whisenand's condescending remarks: "I am afraid they don't really understand the problem" and "Get out of your dream world".

Whisenand is an able architect and quite naturally his dream world, his whole life, is the design of buildings.

To be fair, I must admit that I like some of the high rises; some are indeed beautiful structures. I live in one of them.

It was built on a site that originally had four houses and four families. My 36-floor building houses 173 families where previously there were only four. That's the increased density that Whisenand is looking for.

Honolulu now has both ends of the spectrum: The open estate way of life, and people density, layer on layer. Which to choose, or, what tack must we pursue?

Whisenand, caught up in the architectural world, unfortunately rationalizes incorrectly that "Honolulu's problem is basically the same as every other metropolitan community in the world". Taking that as his departure point Whisenand is already far far off the mark.

Honolulu's problem is decidedly NOT the same as every other urban community such as Shanghai or San Francisco.

SAN FRANCISCO, for example, has crammed its people into every niche within the city limits. High rises jut up everywhere and some are quite beautiful.

There are few more striking buildings in the world than the pyramid Trans-Am building in San Francisco.

The major difference between San Francisco and Honolulu is that San Francisco can support a growing density if it chooses to drown in people.

Honolulu cannot unless Honolulu wants to live like some of the people in Calcutta or Kathmandu or Shanghai.

Years and years ago San Francisco discovered that city wells would not support its growing population. The Hetch Hetchy reservoir located 250 miles away in Yosemite was tapped and water is piped all the way to San Francisco.

Harlan G. Koch

Los Angeles, New York City, Hong Kong and Shanghai also support their millions with water piped from far distant reservoirs.

These are reservoirs that Honolulu does not have and never will have.

Whisenand has to face up to the fact that we are on a small speck of island approximately 2,500 miles distant from the nearest other water resource, the Mainland.

Some mention the desalinization of sea water as being just over the horizon and that's pure wishful poppycock. The Arabians literally have money to burn but even they have discovered that to desalt sea water is an ultra-expensive project.

We could flush toilets with salt water if any of the architects had such special plumbing as a part of their Honolulu building specifications. None have. So Honolulu's problem is far from being basically the same as every other city of the world. What then happens to paradise with increasing people density?

WHERE FOUR FAMILIES of water-users once live, there are now 173 families stacked in the same Waikiki space. That's just one building.

They are all busily flushing toilets, washing clothes and dishes, and hopefully taking showers.

As long as government makes it legal to stack people then all the cries of the Marilyn Bornhorsts will be for naught.

Just a few months ago government was telling you not to water your lawn or wash your car because all of the island's water resources were alarmingly drying up deep in the bowels of the island.

Sugar cane planters were being told that the industry used too much water and it had to go; developers want to stack people on those plantations and people don't use much water — they say.

And at this same water-short period the hell-bent government was issuing even more building permits for greater and greater people density, almost with reckless abandon.

So, no matter what a developer tells you, or a government servant devoted to a particular developer group tells you, or any of those associated with the big building trade attempt to tell you, it is a pure scientific fact that Oahu has a fixed capacity for underground water storage.

In wet years, such as this past winter, we will have more than enough. In past dry years, even without the planned new hordes of people, we did not have enough water.

WE CANNOT REFUSE to let people come to Oahu; that is not only un-American, it's ridiculous nonthinking.

However, if there is no place for them to live without someone else selling out, then they will not come (to stay) unless they camp out. You guessed it. Highly-restricted building permits will slow down the island's runaway population explosion. Admittedly that's a little unfriendly.

I would hope that we do everything intelligently possible to maintain our island paradise. That we do not ruin the quality of life through people stacking and our inability to later support this stacking.

We do have a special problem in Honolulu unlike almost any other growing city in the world!

Harlan Koch takes issue with the premises of architect George Whisenand on the problems of Oahu, particularly as they pertain to water.

Koch, president of the store Fabulous Things, has a background in engineering and geology. He has done research on ground water with the U.S. Army Engineers in Illinois and Thailand.

HONOLULU IS NOT SAN FRANCISCO

TEACHER NOTES

1. (a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of water?

The article states that Oahu has a fixed and limited capacity for water storage. Amount is the issue focus.

(b) What is the position or opinion of the person who wrote the article?

Koch's opinion is that Oahu's fixed underground water storage necessitates limited population growth. He advocates restricting building permits as a means of slowing down Oahu's population "explosion".

(c) Are several opinions expressed? What are they?

Whisenand, an architect, sees increased density (more people in the same space) as a common problem for large cities. He advocates doing what other cities have done - build more high rises (apartments, condominiums) to accomodate the increasing population.

Koch feels that Oahu's limited water storage dictates limiting population growth.

(d) Is there a conflict mentioned either directly or indirectly? What is it?

Yes - whether or not Oahu's population growth should be limited because of our limited water storage or Oahu could accommodate its increasing population through the building of more apartments, condominiums, etc.

In this particular article it is interesting to note Whisenand's (the architect) somewhat biased stereotyping of women as seen in the first paragraph. If none of the students commented about this, you might want to point it out.

Star Bulletin
January 31, 1979

Hilo Coast Sugar in 'Imminent' Peril

By Llewellyn Stone Thompson
Big Island Correspondent

PEPEEKEO, Hawaii—"The Hilo Coast area is in imminent danger of going under" and needs state and federal help for its ailing sugar industry, Terris Inglett, vice president of the Hilo Coast Processing Cooperative, said yesterday.

Inglett issued the call for help to state legislators last week and again discussed the urgency of the problem at a news conference. Participating in the news conference were Stephen Knox, Mauna Kea Sugar Co. vice president; and Francis Pacheco, president of the United Cane Planters' Cooperative.

The Hilo cooperative (HCPC) is owned by C. Brewer's Mauna Kea and the 350 small growers making up the United Cane Planters' Cooperative.

Mauna Kea and the independent growers are equally represented on HCPC's board of directors, although Mauna Kea provides about 70 percent of the cane which HCPC processes.

Inglett said Mauna Kea last year lost $4.75 million and independent growers lost $1.3 million.

THE ORIGINAL membership of the United Cane Planters has fallen from 400 members in 1971 when HCPC was formed, to 350. These growers plant areas ranging from one acre to 700 acres, with the median being 25 acres.

As independent growers one by one cease production, Mauna Kea Sugar is obligated by contract with banks to take over all but marginal lands and continue planting, Pacheco said.

But as more and more independents go out of production, C. Brewer will become increasingly unwilling to underwrite the growing losses of Mauna Kea Sugar, he said. When Mauna Kea goes out of business, HCPC will follow.

The economic impact of some independent growers going out of business has not been felt so far because many of the independents are part-time farmers who have other sources of income.

But if the entire Hilo coast sugar industry collapsed, 910 persons would lose direct employment and 2,084 secondary jobs would be lost, the industry calculates.

ABOUT 3,000 people added to welfare rolls would cost the state about $15 million a year, Inglett said.

So it is in the state's interest to assist with requests the industry made last week to the governor and legislature. Those requests include subsidies to growers who contribute to biomass utilization (HCPC power plant is 75 per cent powered by bagasse), long-term low interest loans to retire current high interest debt, a crop loan program for independent growers, and assistance for the solid waste disposal program.

Before environmental restrictions were imposed, dirt washed off sugarcane at the mill was dumped in the ocean. Now $1.7 million per year is spent to clean waste water from the mill of dirt and bagasse.

HCPC is trying to help itself by cost reductions including less overtime, foregoing some maintenance, attempting to extend its loans, hiring fewer outside contractors, and reducing the oil it burns to generate electricity, Inglett said.

HCPC produces 22 percent of the Big Island's electricity, but is locked into a contract with the Hawaii Electric Light Co. and lost $243,000 last year, he said.

INGLETT DENIED that the news conference was designed to affect negotiations on the sugar worker's contract which expires at midnight tonight. The ILWU has asked for a 60 cents per hour wage increase. The sugar industry has proposed no pay raises for workers at Mauna Kea and HCPC, which the industry claims are "distressed" companies.

Pacheco said he feels "a little bit optimistic" that Congress will pass some kind of sugar relief legislation this year.

But President Carter should be more aware of the damage foreign sugar is doing, Inglett said, suggesting a telegram to the president reading, "Dear President Carter, do you want a domestic sugar industry or don't you?"

Carter has set a "target price of 15 cents per pound, not enough to save the industry," he said.

ENVIRONMENTAL EFFORT—One of the steps required by e vironmental protection rulings, which the Hilo Coast sugar grow say cost them money, is this series of 14 terraced ponds, to tr soil from dirt-laden water from the mill at Pepeekeo. About 1,2 tons of soil a day are deposited in the ponds before the cleanin plant water reaches the sea.

HILO COAST SUGAR IN 'IMMINENT' PERIL

TEACHER NOTES

1. (a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of water?

One of the steps required by environmental protection rulings, which the Hilo sugar growers say cost them money, is the cleaning of waste water before it is dumped into the ocean. This article focuses on the cost of cleaning waste water.

(b) What is the position or opinion of the person who wrote the article?

Inglett, vice-president of the Hilo Coast Processing Coop, says that sugar growers may go out of business because of financial problems. One large expense suffered by the sugar processers is that of cleaning the dirt and bagasse from waste water.

(c) Are several opinions expressed? What are they?

The only opinions expressed in the article are those of people involved in the sugar industry.

(d) Is there a conflict mentioned either directly or indirectly? What is it?

Indirectly a conflict is implied. Whether or not the state and federal governments will help the sugar industry in solving some of its financial problems is the primary issue. The article gives background information from the sugar industry's point of view as to why some of the financial problems exist. Part of the financial problem is the cost of protecting the environment by cleaning the waste water.

Star Bulletin

March 23, 1979

Windward Water

Waikane can be developed into country estates, with swimming pools and the whole bit, but Waihee farmers cannot have the water that they need. If there is logic in this, it escapes me just as it escaped Charlie Reppun as a result of the Waihee water court decision.

Small wonder Charlie's righteous outburst of anger at the legal victory that left the taro farmers without sufficient water! For the logical key to the whole planning process on our island should be water.

There is land on Windward Oahu, land which probably supported a large Hawaiian population when water was not being diverted to other uses and was not extravagantly flowing into sewer systems.

The big difference with taro farming is that most of the 4 million gallons per day of cool running water required is not used, but is returned to the stream or remains in the water table to be available to the next user.

It should be alarming to everyone that Hawaii is presently importing 80 to 85 percent of its food, and the fuel to transport that food is skyrocketing.

The implications are greater even than the fight to maintain a simpler life-style. We shouldn't wait until too late to decide how many people our island can accommodate and with what kind of development.

We shouldn't wait too long to insist that our political bodies finally seriously consider all kinds of recycling — especially our precious water supply.

Does the Board of Water Supply ever consider ways of tapping the water after it has been used by the farmers rather than tapping at the original source?

It doesn't take too many decades to turn a lush island into a desert. At the very least, beginning intensive conservation education and legislation can be delayed no longer.

Lola N. Mench

WINDWARD WATER
TEACHER NOTES

1. (a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of water?

   The article discusses the use of water by taro farmers. The article makes a plea for supporting agriculture, specifically taro farmers and for limiting urban development in agricultural areas.

   (b) What is the position or opinion of the person who wrote the article?

   Mench supports taro farmers, agriculture, recycling of water and intensive conservation education.

   (c) Are several opinions expressed? What are they?

   Only Mench's opinion is expressed.

   (d) Is there a conflict mentioned either directly or indirectly? What is it?

   Indirectly a conflict is mentioned. Evidently the Waihee water court decision favored the water needs of urban development rather than the taro farmers.

Waihee Stream's troubled waters

Sunday
Star Bulletin-
Advertizer

February 18, 1979

In Hawaii, quiet streams and rivers have a habit of churning big controversies.

It happened in 1959 with the Hanapepe River on Kauai. And it's happening again, this time with the Waihee Stream, which flows in the Waihee Valley of Windward Oahu.

The case involving the Hanapepe River resulted in a landmark Hawaii Supreme Court decision that is still winding its way through the courts. And, observers say, it's likely that the Waihee case will follow the same course.

Last week the waters of the Waihee Stream were the focus of a trial before Circuit Judge Arthur S.K. Fong, who will render a decision on Thursday.

Six Waihee taro farmers are fighting the Honolulu Board of Water Supply because water development projects in the Waihee mountains have dropped stream levels.

The farmers are asking the court to halt operations of some wells in Waihee to restore a minimum flow of 4 million gallons daily in Waihee Stream — the amount they say would provide the cold, rushing water taro needs. In August 1977, they won a preliminary injunction awarding them 2.3 million gallons daily.

But the water board says the Waihee sources are essential for meeting the water needs of Windward Oahu residents.

Development of the vertical water-storing compartments in Waihee began in 1955, when the board put in a tunnel that siphons up to 4 million gallons daily from the dikes. In 1972, it added two wells diverting 2 million gallons and, in 1976, installed four inclined wells with a capacity of 2 million gallons.

The total cost of the Waihee developments is $1.6 million.

The Waihee case is far from being just a farmer's fight for water. It has raised difficult questions about water priorities and allocation — the kinds of questions Hawaii and its decision-makers no longer can ignore:

• Who has more important water needs — six taro farmers and their 15 acres of taro or 120,000 Windward residents?

By Vickie Ong
Staff Writer

• How important is it for Oahu to continue to grow taro — once the staple crop of old Hawaii and the basis for such Island foods as poi and kau yuk with taro — when it requires so much water?

• What is the value of a stream and the wildlife, plants, fish and human life it supports?

• How will the inevitable conflict between people and plants be resolved if the population keeps growing and the state wants to expand diversified agriculture?

It became clear during the trial that the balancing of "equities" in the Waihee cases — the unenviable task now before Fong — is a microcosm of the policy conflicts yet to be tackled by state and city agencies, political leaders and the Legislature.

The problem: Water, once plentiful, has become a valuable "scarce resource" because water development on Oahu has reached a point where most "easy" sources have already been tapped.

As a result, new water sources will become increasingly difficult to locate and develop — making water more expensive for the consumer and any source of cheap, fresh water look very attractive to the water board.

It is likely that those who now use water from streams will have to fight to keep the water flowing — just as the Waihee farmers are now doing.

Moreover, Oahu residents will find that giving lip-service to the "conservation ethic" will not be enough. Coincidentally, on Thursday, the water board will hold a hearing on proposed water rates that go up during the summer months as a conservation incentive.

Last week, the talk about water needs focused on the lush Windward side, where the Koolau Mountains serve as a sponge that captures water and spills it down to the ocean through waterfalls and streams.

On a long-term basis, the board will be trying to place wells in the inland areas between Punaluu and Laie.

WAIHEE STREAM'S TROUBLED WATERS
TEACHER NOTES

1. (a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of water?

Primarily the article discusses the uses of water and which uses should have priority. The article also mentions the cost of water.

(b) What is the position or opinion of the person who wrote the article?

Unfortunately, the entire article is not available; however, the writer states that questions about water priorities and allocation can no longer be ignored. The author poses four questions/decisions that are central to the water issues involving Windward Oahu.

(c) Are several opinions expressed? What are they?

No particular opinions seem evident. The article provides background information with references to future water decisions.

(d) Is there a conflict mentioned either directly or indirectly? What is it?

The conflict as stated in the article is: "Water, once plentiful, has become a valuable 'scarce resource' because water development on Oahu has reached a point where most 'easy' sources have already been tapped."

Water Rate Hike, Conservation Asked

By Harry Whitten
Star-Bulletin Writer

"Rain, rain go away.
"Come again some other day."

Oahuans have been singing this song lately, but water isn't as free as the song might suggest.It costs money to collect and supply it and the consumer must pay to get water from his tap.

The Honolulu Board of Water Supply says it needs more money to accomplish this. And looking back on recent droughts, the board says it wants to encourage conservation to cut down the need to develop new water supplies.

The board hired the consultant firm of Folk and Gilbert and they have developed a new water rate scheduled aimed at bringing in more money and encouraging conservation.

The board will hold a hearing at its headquarters at 630 S. Beretania St. at 7:30 p.m. Thursday to give the public a chance to comment. (Enter from the parking lot side.)

Here are the details of the proposed schedule to replace the one that went into effect when the rates were last changed, in July 1978:

QUANTITY CHARGES—Consumers now pay 45 cents per 1,000 gallons, year round. People use more water July through October and the water board says it wants to encourage conservation during those summer months.

So the consultants have proposed a four-step program:

From July to October this year rates would be increased to 84 cents per 1,000 gallons.

From November 1979 through June 1980, rates would drop to 63 cents per 1,000 gallons.

From July 1980 through October 1980 rates would go up to 91 cents per 1,000 gallons.

From November 1980 through June 1981 rates would drop to 68 cents per 1,000 gallons.

SERVICE CHARGE—The charges now range from $3.85 to $240 a month depending on meter size. The charge is to pay the cost of reading meters and billing and collecting.

The consultants say the charge is inequitable. "The present system of rates leads to the smallest meter-size classes paying a proportion of revenue that is substantially larger than the share of water they use, and therefore discriminates against the smaller meter-size classes," they say.

The proposed charges would be a flat $1.25 a month for consumers billed bimonthly and $2.50 a month for monthly consumers, regardless of meter size.

The lower service charges would partly or wholly offset for many families the increases in the quantity charge.

Water Will Cost 11% More in '79

The typical Oahu water consumer is expected to spend 11 percent more for water this year, under the present rate of 45 cents for 1,000 gallons, up from 37 cents last year.

The total spending will not increase as much as the rate did, the Board of Water Supply estimates, because the typical user is expected to cut his consumption from 159,000 gallons last year to 155,000 gallons in 1979.

Including the meter service charge, the typical consumer spent $104.94 on water last year.

In 1979, the same user—with a five-eighth inch meter—is expected to spend $116.12.

If he reduces consumption to 141,000 gallons in fiscal 1980, his annual bill would be $114.06, despite the proposed rate increases. But if he does not practice conservation and continues to use 155,000 gallons, the bill would be $124.62 a year under the proposed rates.

In fiscal 1981, the user who cuts consumption would spend $122.08 a year under the proposed rates. The customer who continues to use water at the same rate would spend $133.50 a year.

FACILITIES CHARGE—This is for hooking up a new customer to the system. The consultants say present charges, which range from $250 to $10,000, depending on size of meter, should be increased to $1,000 (for the smallest meter, five-eighth inch) up to $655,000 for a 16-inch meter.

This would mean much greater charges for big users, such as condominiums, hotels or industries.

AGRICULTURE—The consultants recommend doing away with the special water rates for agriculture.

"However desirable agriculture as an activity may be, it is not appropriate that other customers of the Board of Water Supply must provide agricultural customers with a subsidy in the form of lower water rates," they say.

"Poor people, schools, charities, hospitals and other individuals, groups and organizations might be thought to deserve special breaks in prices, but they pay the general water rate."

This recommendation is expected to be controversial. Already Robert A. Souza, one member of the Board of Water Supply, has said he will oppose it.

The special agricultural rates were discontinued in 1975, but under pressure from small farmers, reinstated in 1977. The state's other counties give farmers special water rates.

ELECTRIC RATES—The consultants recommend that any increase in electric power rates be automatically passed on to customers. Hawaiian Electric Co. now increases its power rates when its fuel prices increase.

The consultants recommend that the general quantity charge for water be increased by one cent per 1,000 gallons for every 10 percent increase in power rates.

Electric power usage by the water system is primarily for pumping; if conservation cuts down pumping needs, power usage also may be reduced.

SPECIAL CHARGES—These include a minor increase in the automatic fire sprinkler rates for services connected to alarm systems.

JUSTIFICATION—The number of customers and costs of serving them have grown. Operating expenses for the BWS are expected to increase from the budgeted $25.9 million in fiscal year 1979 to $27.5 million in fiscal 1980 and $29.8 million in fiscal 1981.

Salaries increased by 8.3 percent in fiscal 1977 and by 3.9 percent in fiscal 1978, despite a drop of 12 positions from the previous year. Debt service expenses rose to more than $4.3 million and cost of electrical power to nearly $3 million.

REVENUES—With the changes, estimated revenues are projected to increase from the budgeted $27.1 million in fiscal 1979 to $28,950,000 in fiscal 1980 and $31 million in fiscal 1981.

Star Bulletin

February 20, 1979

WATER RATE HIKE, CONSERVATION ASKED

TEACHER NOTES

1. (a) What does the article say about water? Does it discuss the use, the amounts, the cost of water, the cleanliness of water?

   This article discusses the amount of water used and the cost of that water. The article describes a new water rate schedule aimed at bringing in more money and encouraging conservation.

   (b) What is the position or opinion of the person who wrote the article?

   The purpose of the article is to explain the proposed water rates. The position is that the Board of Water Supply needs more money to collect and supply water to its customers. Rate changes are recommended for home users, big users such as condominiums, hotels, industries, and agriculture.

   (c) Are several opinions expressed? What are they?

   All the opinions expressed are from the Board of Water Supply viewpoint. The comments are made in support of the proposed water rates.

   (d) Is there a conflict mentioned either directly or indirectly? What it it?

   A possible conflict is expected in doing away with special water rates for agriculture.

Honolulu, Dec. 3, 1978 The Sunday Star-Bulletin & Advertiser

Policy favors conservation for 'long run'

By JERRY BURRIS
Advertiser Politics Writer

When the Legislature meets in January, it faces the task of putting flesh on the bones of the landmark state plan adopted last year.

That plan, the first in the nation, sets out basic goals and priorities for Hawaii for the last quarter of this century. The vision is for a strong diversified economy, a pure environment and a stable social system.

To help the Legislature and the counties come up with specific policies to implement that plan, the state Department of Planning and Economic Development recently prepared a series of "issue papers" to identify ways of achieving those goals.

The first six issue papers — on the economy, agriculture, social issues, limited physical resources, housing and population — were recently sent to the Legislature. The issue papers give an inkling of the priorities and policies that could arise from the state plan.

In this and subsequent articles, The Advertiser will briefly outline some of the more intriguing ideas put forth in the first series of issue papers.

Measures designed to protect Hawaii's limited physical resources will dampen economic development — at least in the short run — and will further erode private property rights, a "policy paper" prepared by the state Department of Planning and Economic Development says.

But the paper says there is no choice but to conserve physical resources because the long-term costs would far outweigh the short-term disadvantages.

If the demand for water exceeds traditional supply, for example, the alternative will be expensive desalination plants, which, the paper says, could boost water bills three-fold.

As resources become scarcer, it is the poor who will get shut out, the paper notes. "In time only those with available funds may be able to enjoy resources all the residents of Hawaii enjoy today."

The paper suggests that government follow five basic policies, in the following order of importance:

• Retain all land critical to the viability of the agricultural industry for present and future agricultural use.

• Exercise a conservation ethic in the use of water and energy resources.

goals for Hawaii's future

• Reorient the ocean shoreline to public use and access.

• Ensure efficient, healthy, well-designed and functional urban developments.

• Apply extremely restrictive standards for the use of conservation lands.

Each of these policies would require specific efforts.

In agriculture, for instance, the paper says the private agricultural industry should be helped through tax breaks, federal assistance, increased government loans, more promotion and more government money for research and development.

The state must also work through the schools and private industry to convince young people agriculture is a good career choice, the paper says.

Limits on redistricting of agricultural lands could be helped by isolating all lands vital to agriculture and then locking them within agricultural districts under the state land use system, the paper suggests.

It also says agriculture should be maintained on Oahu despite the heavy pressures for urbanization in Honolulu.

Conservation lands could be protected in several ways, the paper says.

Reclassification out of conservation should be allowed only under "the most urgent and compelling circumstances," it says. The state should also watch conservation districts to make sure they are used properly and it should not allow urbanization next to conservation lands because it tends to have a contaminating effect, the paper says.

Quality urban developments should be self-explanatory, the paper says, but it does offer some guidelines to insure that objective.

The state should discourage "scattered" urbanization which isn't contiguous with existing urban areas, the paper says, and urban developments should be permitted only when there is a clear need to accommodate growth.

Speculation should be stopped by passing laws which require urban developments to be completed within a "reasonable" amount of time and reclassification of land from agriculture to urban should be prohibited for five years after agricultural use ceases, the paper suggests.

An important goal, the paper says, is to "reorient" the shoreline to greater public use and access.

"Unfortunately, the residents of Hawaii are being cut off (from the ocean) through various urban activities, basically those of the visitor industry," the paper says.

"The economic returns to a few have become more important than the social value to the public. It is time to reverse this. And what is needed is not merely physical access. . . . What is needed is psychological access — a feeling of welcome, of invitation to use and enjoy what is rightfully the public's: the shoreline and the sea."

No development makai of the highway should be allowed where it is determined that the shoreline areas have recreational or scenic value, the paper adds.

Even though physical access to the beaches is provided throughout the state, residents sometimes feel they are being shut out by "tourist enclaves," the paper says.

There are "tradeoffs" in all of these policies, the paper admits.

"The primary tradeoffs appear to be the possible loss of accelerated economic growth and a further reduction in an individual's flexibility in the use of his property, in return for the long-term stability of economic growth and increased benefits for the general public," it says.

Policy Favors Conservation for "Long Run"

Teacher Notes

1. (a) What does the article say about water? Does it discuss the uses, the amounts, the cost of water, the cleanliness of water?

The article discusses the limited supply of fresh water. This article is a brief outline of part of the Department of Planning and Economic Development's plan of basic goals and priorities for Hawaii. The DPED advocates a strong diversified economy, a pure environment and a stable social system.

(b) What is the position or opinion of the person who wrote the article?

The article suggests five basic policies:

1. Retain all land critical to the agricultural industry.
2. Exercise a conservation ethic in the use of water and energy resources.
3. Reorient the ocean shoreline to public use and access.
4. Ensure efficient, well-designed urban developments.
5. Apply extremely restrictive standards for the use of conservation lands.

(c) Are several opinions expressed? What are they?

The only opinions expressed are those of the DPED.

(d) Is there a conflict mentioned either directly or indirectly? What is it?

The conflict over resource use, particularly land use, is implied.

Where Does It Rain?

I. Observation

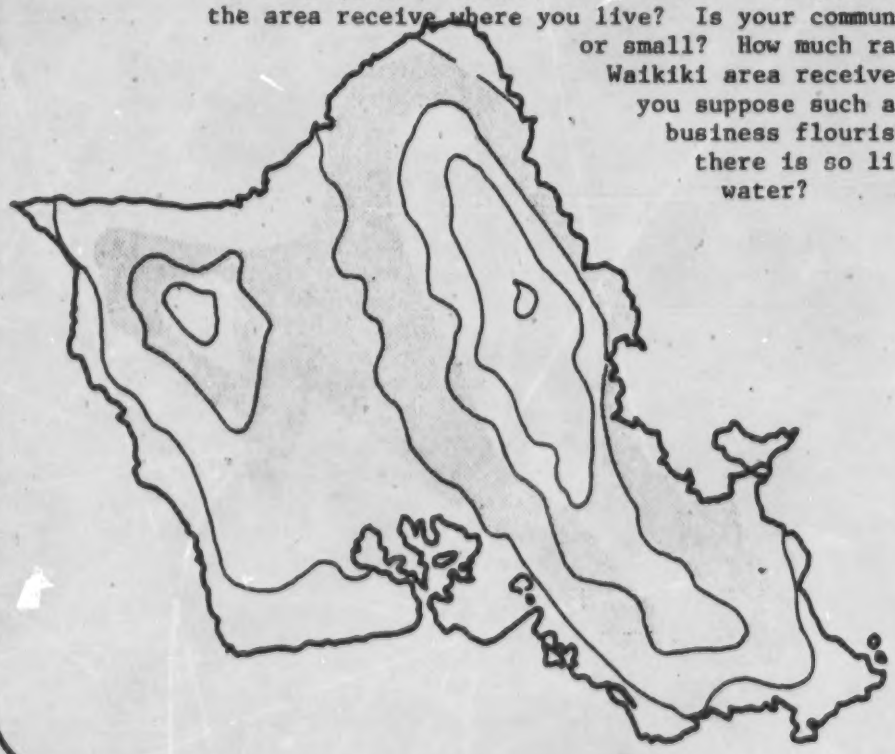
Waianae, Oahu	12 inches rainfall per year
Kahuku, Oahu	35 inches rainfall per year
Honolulu, Oahu	24 inches rainfall per year
Waiahole, Oahu	180 inches rainfall per year

II. Discussion

You and your family need and use much water. As we have discovered, all people need water. Unfortunately, however, the rain does not always fall when or where it is needed. The uneven distribution of water can be a contributing factor to a water problem.

Questions to Ask

Look at the population map of Oahu, then look at the rainfall map for Oahu. Do most of the people on Oahu live where the most rain falls? How much rain does the area receive where you live? Is your community large or small? How much rain does the Waikiki area receive? Why do you suppose such a large tourist business flourishes where there is so little fresh water?



WHAT TO DO

1. Make a large map of Oahu. Using colors show the different rainfall amounts. Then using some symbol to represent population, place the population densities on the map. Now on one map you can see where it rains and where the people live. Compare your map with others to be sure you have combined your findings accurately.
2. State a problem that might arise because rainfall is distributed unevenly.

ADDITIONAL ACTIVITIES

1. Look at a map showing Oahu's major agricultural crops and where on the island each is grown. Then try to determine the water requirements for raising each agricultural product. Are the crops grown where the necessary water is readily available? If not, why do you suppose not?
2. Why do you suppose the people on Oahu live where they do? Is it where most of the rain falls? What other factors besides water do people consider in deciding where to live? If possible locate a map showing where the ancient Hawaiians lived on Oahu. Is the current population heavy in these areas?
3. On a worldwide scope, look at world population and rainfall maps. Generally, are the world's largest cities located within the world's greatest rainfall areas? Are populations heaviest around rivers and lakes?

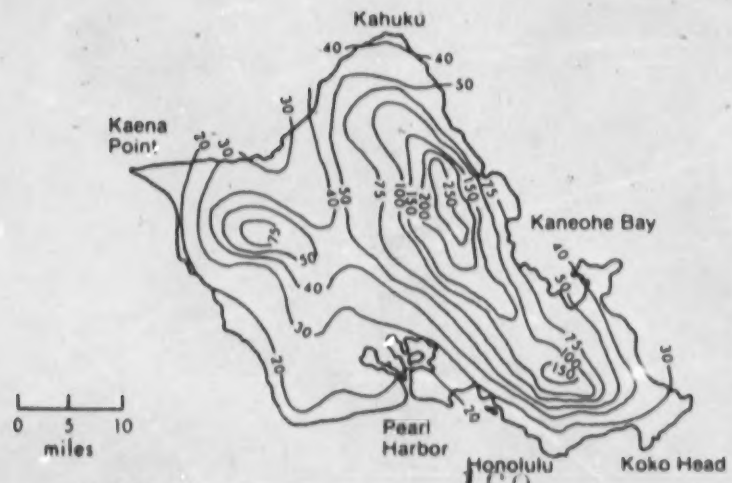
EXTEND YOUR THINKING

1. Rain does not fall evenly over Oahu. Different groups or industries require much water, just as individual citizens require much water. Remember what you learned about cycles and systems; an economic system also exists where industries rely on people as workers and consumers. In turn people rely on industries as a source of income and goods or services. In times of water shortages decisions must be made as to who gets the water they need and who is told to cut back on water consumption. What do you think should be done when Oahu experiences water shortages? What are our vital or necessary industries? What groups might be asked to limit consumption? Who should make these kinds of decisions?
2. If you were going to establish a community, what kinds of things would you consider? Where are the most "logical" places for people to live?

SUGARCANE and PINEAPPLE

POPULATION 1970

ANNUAL RAINFALL



WHERE DOES IT RAIN
DIGEST

I. PREPARATION

These materials should be available for student use:

- atlas
- reference books
- drawing paper
- crayons, pastels, colored chalk, etc.

VOCABULARY

distribution
population
flourish

II. STUDENT ACTIVITIES

Question: Where on Oahu does it rain?

1. Students will combine information from rainfall and population maps onto one map.

2. Students will state a problem(s) caused by uneven rainfall distribution.

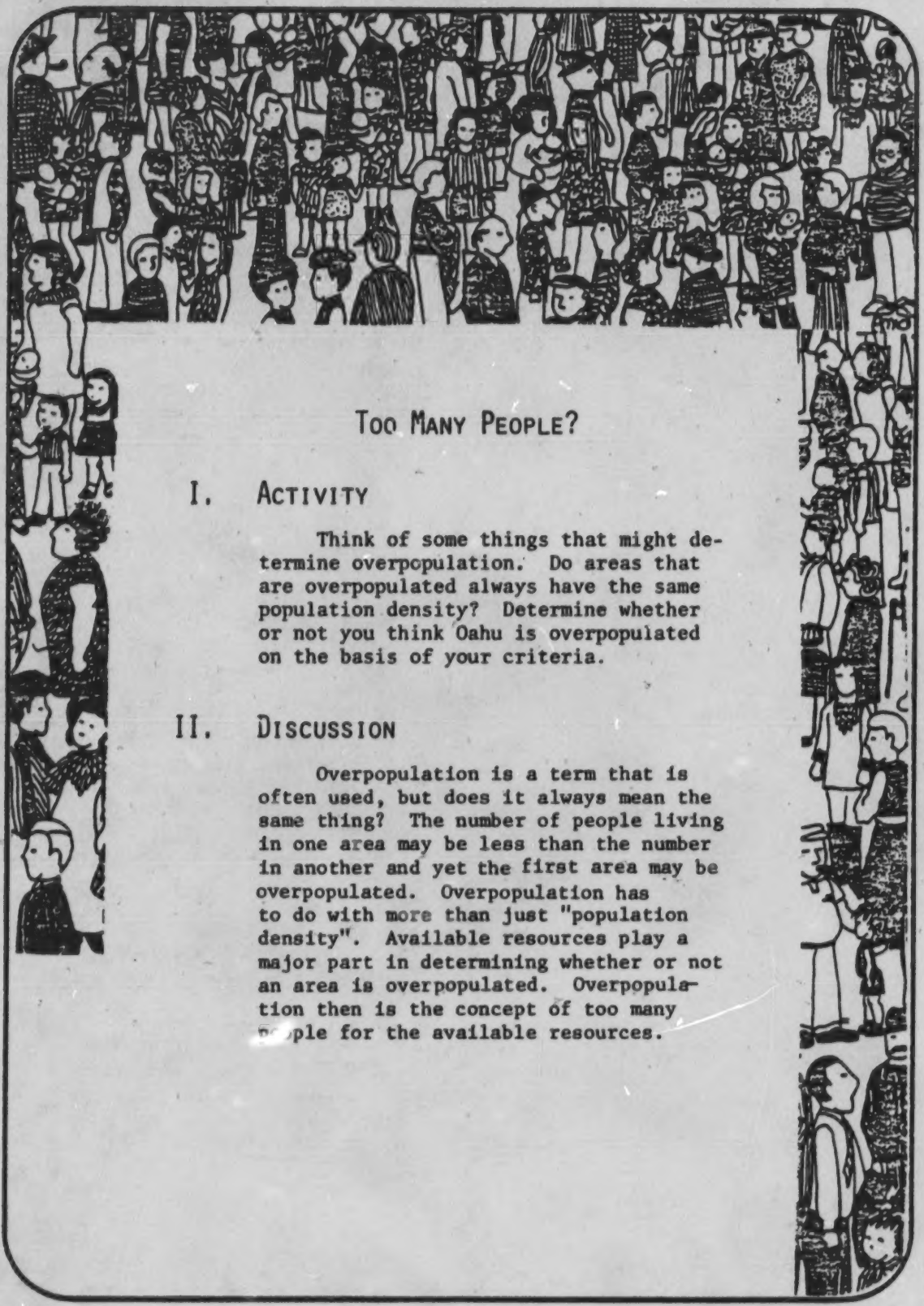
For additional activities, these are the approximate water requirements:

pineapple:	this crop is an arid area plant requiring little or no irrigation
sugar cane:	230-240 million gallons per day

III. SUMMARY

Because rainfall and population densities are not necessarily congruent, water supply/demand creates problems.

With "extend your thinking" students may need help as they explore the economic interdependencies on Oahu. Some discussion of what would happen if a particular segment of the economy were halted might be useful. (eg. The United Airlines strike in 1979 caused a marked decrease in tourists traveling to Oahu which in turn caused hotels to suffer which led them to "lay off" workers. All of these actions caused less money flow on Oahu.) What would happen if their parents' jobs were eliminated - who else or what other groups would it affect?



Too Many People?

I. Activity

Think of some things that might determine overpopulation. Do areas that are overpopulated always have the same population density? Determine whether or not you think Oahu is overpopulated on the basis of your criteria.

II. Discussion

Overpopulation is a term that is often used, but does it always mean the same thing? The number of people living in one area may be less than the number in another and yet the first area may be overpopulated. Overpopulation has to do with more than just "population density". Available resources play a major part in determining whether or not an area is overpopulated. Overpopulation then is the concept of too many people for the available resources.

THINGS TO DO

1. Figure out the population density for Honolulu, For Oahu. You may have to use a variety of resources to get the census and square miles you need.

2. a) Make a list or chart of the resources necessary for life and where they come from here on Oahu. Include information on the present supply of each of these resources.
   b) Now compare the population density with the available supply of resources. What other information will you need to be able to determine whether or not you are living in an overpopulated area?

ADDITIONAL ACTIVITIES

1. Estimate the maximum population that could be supported on Oahu with the present water supply.

2. Find a city on the mainland or in another country that has a population density similar to Honolulu's. Compare the available resources in each place and decide which is able to support its population more comfortably.

3. Write a poem, short story or skit about what life would be like in the future if out resources remained the same and our population tripled! Try to imagine what it would "feel" like and include those feelings.

SUMMING IT UP

Using what you have learned about the concept of overpopulation, explain how the following could be true.

The people living in Holland say that even though the population density there is as great as in Japan, they are not "too crowded". They say that their population density is much higher than that in some small villages in India or Africa that have alot of land surrounding them, but that those places are far more overpopulated.

Too Many People?

Digest

I. Preparation

Arrange to have copies of an atlas (Atlas of Hawaii is recommended) or Hawaii Population Data Sheet available from the Commission on Population and the Hawaiian Future in your room or available for students to use as references. Post the telephone numbers needed to obtain the current population information: the State Department of Health, Research and Statistics Office, Research & Analysis Division 548-6454; the number to call for help in finding the right State agency or office, Office of Information 548-6222.

Vocabulary

population density
census
criteria
overpopulation

II. Student Activity

Activity: Think of some things that might determine overpopulation. Determine whether or not Oahu is overpopulated on the basis of your criteria. Find out the population density for Honolulu and/or Oahu and compare it to the available resources to determine if overpopulation is a problem.

If students choose to obtain the information they need by telephoning State agencies or offices, pre-planning and organization should be stressed. Encourage students to think about the questions they want to ask and write them down before they make their calls. If necessary, help them phrase their questions clearly and concisely so that they are able to get answers which will furnish them with the information they need.

III. Summary

Students will use what they have learned about the concept of overpopulation to write summary tables, poems, short stories etc. to describe the relationship of available resources and number of people in any given area.

WATER: A CASE OF SUPPLY AND DEMAND?

I. QUESTION

What happens if more water is needed than can be supplied?

II. DISCUSSION

In earlier activities you have thought about some of the problems that involve the water supply on Oahu. It is certain that we do have a water problem, and that it is a problem that affects each and every one of us. We know that our water supply is limited but that our needs seem to keep growing. What happens when there is a fixed supply but an increasing need for something? What happens when the demands exceed the supply?

QUESTIONS TO ASK

From what you have learned about water on Oahu, try to answer these questions:

1. Is the water problem an economic one?
2. Is the water problem a political one?
3. Is the water problem a social one?

ACTIVITY

With a group of other students, or with the class, discuss the various demands that are placed on our water supply. Be sure to include what the demand is and who is making it. Once you have made a list, order them according to which you think is most important to those you think are least important. Take turns explaining what your reasons are for ordering them the way you did. Now compare your list to the order in which the demanders of Oahu actually receive their supply. Which is responsible for the greatest demand? Which receives the greatest supply? Are the demands always met by the supply? How are the demands given priority?

SUMMING IT UP

The problem of water supply on Oahu involves a great number of things; there is no easy solution, no simple answer. After considering all the information you have gathered so far, form a committee with several other students and prepare a brief report covering the following topics:

a. the demands on Oahu's water
b. Oahu's water supply
c. water rights/priorities
d. the economic factors relating to Oahu's water problem
e. the political factors relating to Oahu's water problem
f. the social factors relating to Oahu's water problem
g. conflict between groups
h. possible alternatives

* Remember, there are no real solutions. Each time you consider an alternative be sure to think about both sides of the issue.

SOMETHING EXTRA

Supply and demand is a concept that relates to many things, not just water. Think about this economic principle:

When the supply of a product is low and the demand is great, the price of the products tends to be high.

Think of situations in your own lives in which you have seen the law of supply and demand operate. (HINT: What happens to jelly beans after Easter? To Christmas cards after December 25? To the babysitting rates when there is a sudden shortage of babysitters available in your area?)

How does this principle affect you? What can you do to either create a larger demand or a greater supply if you want to? Why might you not want to? What are the consequences of increasing one or the other or both?

WATER: A CASE OF SUPPLY AND DEMAND?

DIGEST

I. PREPARATION

Review concepts and information from activity 2.1.

VOCABULARY

economic
political
social
priority
alternative

II. STUDENT ACTIVITIES

Question: What happens if more water is needed than can be supplied?

1. Students will discuss the various demands placed on Oahu's water supply and order these demands by priority.
2. Students will form committees to report on findings of topics listed under "summing it up".

III. SUMMARY

A review of activity 2.1 will be helpful for information about demands and how those demands are met. While working with the concept of supply and demand, this activity investigates what might happen if the demand exceeds the supply. Hopefully the students will realize that the solution is not simple and that wise decisions concerning priorities are necessary.

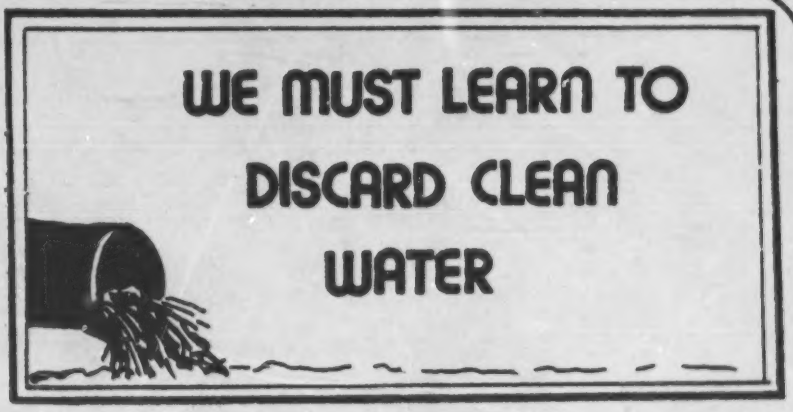
WATER: A CASE OF SUPPLY AND DEMAND?

NOTES

Emphasize that there are no easy "solutions" - that each alternative has certain consequences which must be evaluated. Here again, values enter into the decision making. Another point to bring out is that economic, social and political factors do not operate in isolation. They interact in many ways and in some cases may be so interwoven that it is not possible to view them separately. Questions such as "When is people's behavior economic? Can a person's behavior be social, political and economic at the same time?" may be helpful in getting students to think of the interaction and interdependence of the systems in our society, similar in many ways to that which exists in nature.

This would be a good time to relate concepts that may have been studied earlier in other subjects such as local and national political structures, different economic concerns, the effects of personal values on policy and decision making, etc.

Is There a Solution To Pollution?



I. Question

Might the environment change so that humans could not survive?

II. Discussion

Water is vital - a necessity for life! We know that our life depends on water, yet we often show little regard for the quality of our water supply. As we use our water we are not careful to put it back into the system as clean as when we obtained it. Our waste water or sewage is not always adequately cleaned. Insufficiently treated sewage can result in the spread of water borne diseases. It may promote the growth of algae that results in foul odor and lack of free oxygen, kills fish and in general hastens the "death" of a fresh water supply.

Agriculture uses a large share of available water. Widespread use of fertilizers and pesticides has added to the water pollution problem. If unwise farming practices are followed, our lakes and streams can become heavily silted.

Industry is blamed for a great deal of our water pollution problem. Industry does not usually require a high quality water for its uses, but the dumping of industrial wastes into streams and lakes or into a municipal sewage system causes damage. These industrial wastes may include oil and radioactive pollutants or chemicals used for industrial cleaning. Another common way industry contributes to water pollution is by using water to cool machinery and then dumping the overheated water back into the supply.

THINGS TO DO

1. After the class has been divided into groups, each group will investigate one of the following topics and find the answers to questions that relate to the topic.

   Public Pollution

   1) Describe a pollutant.
   2) Does the term "sewage" refer only to human waste?
   3) What are bacteria?
   4) Is Hawaii's water supply being polluted? If so, where does most of the contamination come from?
   5) List several things that could be done to control/prevent pollution.

   Agricultural Pollution

   1) Describe a pollutant.
   2) In what ways would increased population increase the use of water for agriculture?
   3) What are possible ways to fertilize plants?
   4) Ask a state agricultural agency to explain why farmers use chemical fertilizers. Ask if there are practical alternative ways to fertilize.
   5) Make a list of poisonous chemicals contained in a fertilizer.
   6) Ask your local Environmental Protection Agency or Office of Environmental Quality Control if they feel agricultural pollution is a problem for Oahu.

   Industrial Pollution

   1) Describe a pollutant.
   2) What type of industries use the most water? Are these industries located in Hawaii?
   3) What are the major industries in Hawaii? How do they use water?
   4) Do factories in Hawaii dump their wastes into the city sewage system?
   5) What kinds of industrial wastes are dumped?
   6) Ask your local Environmental Protection Agency or Office of Environmental Quality Control if they feel industrial pollution of Hawaii's water supply is significant.

   Your group should share your findings with the class.

2. Make a chart to show the uses of water and the water quality needed for each use.

Water Standards	
drinking swimming irrigation etc.	98% pure etc.

Is there a Solution to Pollution?

Digest

I. Preparation

None required.

Vocabulary

sewage
algae
phosphates
enzymes
detergents
municipal
pollutant

II. Student Activities

Question: Might our environment change so that humans could not survive?

For #1 in "Things to do" divide the class into three groups and assign each group a specific area: public, agricultural, industrial.

1. Students will answer questions about potential polluters. *Students should check the telephone directory for various environmental protection agencies. If they are unable to locate this resource on their own, the agency to contact is Hawaii (state) Environmental Protection and Health Services 548-6455.

2. Students will construct a chart relating water use to water quality.

III. Summary

This lesson goes from broad nationwide water pollution to a more Hawaii specific look at the problems. In the case of Hawaii some phosphates and some primary-treated sewage may be desirable because our ocean area is lacking in nutrients. Infiltration of sea water into our fresh water is probably our most imminent source of contamination. If wells pull water that is too near the bottom (near the level of brackish water) or if too much water is removed, sea water will contaminate the fresh water.

Is There a Solution to Pollution?

Notes

Upon completion of the activities in Section 5, students will be ready to embark on a more in-depth investigation of Hawaii's water situation. By this time, the students will have identified several of the most important issues and will have begun thinking about what is involved with each of them. Before they can continue their investigation and begin generating and considering alternative courses of action, they may need to have additional background information.

There may be an assortment of books and other materials that you have used with your students at other times during the year that provide the type of basic economic, social and political background they will need to understand the present situation. These may be made available to students as resources to use independently, or you may want to provide more detailed information to them yourself. A review of the following concepts and procedures probably would aid the students in their understanding of the complexities of the water issue:

- the economy base of Hawaii
- the legislative process, especially how a bill becomes a law
- the biases of the various special interest groups (sugar cane, small farmers, ecologists, general public)
- the legal history of water rights in Hawaii
- the processes by which an individual can influence governmental decisions
- the various governmental & non-governmental agencies involved with water; how to contact them as resources.

Emphasis should be on assisting the students in their efforts to obtain information, rather than on providing them with all the information yourself. Whenever possible, guide them towards seeking out the resources they define as a need themselves. The brief resource guide included in these materials may help you channel their investigations to the agency(ies) or person(s) who would be most useful for a specific topic.

Section 6

Alternatives and Consequences

Instructional Goal

When faced with decisions concerning the use of terrestrial and extraterrestrial resources, students will select practices developed in recognition of present and future environmental and human needs.

Instructional Objectives

Identify problems involving soil, water, air and plant life in the community and suggest and defend possible solutions to the problems. Sc, SS, H, N

Suggest political, social and economic reasons for proposing laws about the use of natural resources. Sc, SS, H, C

Cite examples illustrating how water management and conservation practices have affected the usefulness of land. SS, Sc

Performance Expectations

Identifies causes of local environmental problems.

Cites examples of social, political, or economic decisions which have caused environmental problems.

Explains the need for rules to protect the environment.

Identifies state and federal government agencies primarily concerned with environmental management or control.

Identifies non-governmental groups primarily concerned with environmental matters.

Essential Competencies

Communicate orally in situations common to everyday life.

Reach reasoned solutions to commonly encountered problems.

Distinguish fact from opinion in TV and radio news broadcasts, advertising, newspaper and magazine articles, and public speeches.

Demonstrate knowledge of the basic structure and functions of national, state and local governments.

Demonstrate knowledge of the citizen's opportunities to participate in political processes.

Section Objectives

Identify water use and regulation as an important and continuing environmental issue.

Identify some of the users of water who have concerns over its use and regulation.

Practice environmental decision making through a simulated environmental controversy.

Develop awareness of some of the concerns of different interest groups regarding use and regulation of water.

Increase ability to consider alternative solutions to environmental problems.

Increase awareness of the process of change and the role of the citizen in environmental management.

Develop understanding of the complexity of environmental decision making and the fact that there are seldom easy solutions to problems.

THE CONTROVERSY

I. QUESTION

Who needs the water?

II. DISCUSSION

We all need water to drink, to bathe, to swim and just to enjoy. But many others in the community also need water. Water is necessary for industry and for agriculture, for housing projects and for recreation. What are the groups in Hawaii which are concerned about the use of water?

WHAT TO DO

1. Watch the section of the videotape "Water: Man's Greatest Need" that your teacher will play for you.

2. Make a list of the different groups who need water or who are concerned about the use of water. Why does each group need the water? What does each group use the water for? How much do they need?

FIND OUT

Who uses the most of the water in Hawaii? Who decides how much water each group gets? How much longer will the water last? Will we run out of water?

SUMMING UP

Discuss the following question with the class: Why is there a controversy over the use of water in Hawaii?

The Controversy

Digest

I. Preparation

Arrange the following:

videotape player
television
borrowing the videotape "Water: Man's Greatest Need" from Technical Assistance Center, Office of Instructional Services, Phone: 548-6250

Vocabulary

subsidy
controversy

II. Student Activity

Question: Who needs the water?

Introduce the topic by reviewing sections 2 and 5.

Play the videotape #451 to #728 approximately 10 minutes. May also wish to play #360-451 (7 minutes) to provide more background.

Have students identify as many interest groups as possible.

III. Summary

Students should indentify the following groups who use or have an interest in the use of water:

Board of Water Supply - government regulation

sugar growers - large agriculture

small farmers - diversified agriculture

special interest groups - e.g. Life of the Land - ecology

urban use - human consumption

Students will be divided in the next activity to represent each of these interest groups.

WATER REGULATION: WHAT ALTERNATIVES

I. PROJECT

Prepare and hold a mock legislative committee hearing on water control.

II. DISCUSSION

Pretend that there is a bill before the Legislature, Senate Bill 2020 (SB 2020). This bill calls for a law to be passed to control the use of water in Hawaii. If passed, this law would establish a Board of Water Management. This new board would be responsible for controlling the use of all the water in Hawaii. The board could set rates and charge all water users for the amount of water they used.

WHAT TO DO

1. Read the bill. Be sure all members of the class understand what is proposed.

2. Divide the class into the following groups
   a. 5 students are senators who make up the legislative committee
   b. 4 students represent the sugar growers association
   c. 3 students represent the current Board of Water Supply
   d. 4 students represent the small farmers
   e. 4 students represent the homeowners association
   f. 3 students represent the environmentalists
   g. 3 students represent the military
   h. 2 students are economists

3. Meet with your group. Read the information provided for each group.

4. Prepare your testimony for the Senate committee. Use the information given to your group.

5. When called upon by the committee chairperson give your testimony. You must use some kind of visual aid to support your group's point of view.

SB 2020 - A Bill For An Act

This bill 1) declares all fresh water resources in Hawaii to be publically owned and 2) establishes a Board of Water Management empowered with full legal authority to regulate the use of water in Hawaii.

All Water Owned Publically

With the passage of this legislative act, all waters in Hawaii are declared in public ownership.

Establishment of Regulatory Board

A Board of Water Management shall be established. The Board is to consist of 5 members appointed by the Governor.

Jurisdiction

The Board of Water Management shall control and regulate all fresh water in Hawaii.

Setting of Rates

The Board shall have the power to set rates for all users of water. Public hearings shall be held on all rate structures. Proposed rate structures are subject to approval of the Legislature of the State of Hawaii.

SENATE COMMITTEE ON RESOURCE MANAGEMENT

GETTING STARTED

Meet with your group. Decide who will be Chairperson of the Committee. Select a committee secretary to take notes, and a recorder to tally testimony during the hearing.

PLANNING

Plan how the hearing will be conducted.
Where will the Committee be seated?
Where will the speakers give their testimony?
What are the rules for presentations?
Set a time limit for speakers.
Who can ask questions?
When will questions be allowed?
Discuss what the possible alternatives are for the Bill.

Passed as is to the floor of the Senate for a vote.
Revised - how?
Tabled - what additional information might be needed?
No action - what happens to the Bill then?

Decide the order in which the testimony will be given. Who will speak first, second, third. etc.

CONDUCTING THE HEARING

When all the groups are ready call the meeting of the Committee to order. The chairperson should announce:

> "This hearing of the Senate Committee on Resource Management is now called to order. I want to thank all of you citizens who have come here today to give your testimony. I assure you that we will all listen to each of you very carefully in this hearing."

Announce your rules of procedure and call the first speaker.

ADJOURNING THE HEARING

Adjourn the hearing after all the testimony has been given and all the questions answered. Thank everyone again for their participation.

MAKE A DECISION

Meet with your committee and decide what will happen with your bill. Report your decision to the class. Give your reasons for your decision.

Roles for the Senate Committee on Resource Management

The Chairperson

- maintains order
- call speakers
- recognizes people who wish to ask questions
- helps decide what action to take on the bill

The Secretary

- makes notes of important points made
- asks questions of speakers
- helps decide what action to take on the bill

The Recorder

- writes on the board a list of those who favor the bill and a list of those who are against the bill
- asks questions of speakers
- helps decide what action to take on the bill
- helps groups post their visual aids

Other Committee Members

- asks questions of speakers
- listens carefully
- helps decide what action to take on the bill

Sugar Growers Association

Your group is opposed to Senate Bill 2020.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the committee calls on your group present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. My name is _____. I represent the Hawaii Sugar Growers. We are opposed to SB 2020 for the following reasons. (Give your testimony. Show your visual aids.) We recommend the following action be taken on SB 2020. (Give your recommendations.)

Sugar Growers Information

You know that the sugar industry has a long history in Hawaii of leadership in water development. The discovery and first tapping of the lens was done with the money and expertise of the sugar growers. At present, the industry uses about 60% of the water. It uses the water free of charge. Point out that much of the water is recycled and percolates back through the ground to the lens. The industry also uses water that consumers will not drink.

You know that sugar keeps Hawaii green and alive. Some 9,000 jobs depend on this industry. Sugar contributes $200 million to $300 million per year to Hawaii's economy. Warn the committee that if the industry has to pay for its water, sugar growing may become too costly and may be stopped resulting in the loss of jobs and state income. You believe that the water should belong to those who can develop it and use it most profitably. Sugar should be allowed to use all the water it can.

You may wish to base your testimony on:

1. Sugar industry right to private development of water.
2. Economics. Charges for water will drive sugar out of business.
3. Water for agriculture should not be regulated.
4. Sugar industry discovered and developed the water resource with its own money and should not have to pay for it now.
5. Other arguments you can think of.

Board of Water Supply

Your group is in favor of SB 2020.

Prepare your testimony using the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. My name is _____. I represent the Board of Water Supply. We speak in favor of SB 2020. (Give your testimony. Show your visual aids). We recommend the following action be taken on SB 2020. (Give your recommendation.)

Board of Water Supply Information

You are aware that the Board of Water Supply controls only about 27% of Hawaii's water. It regulates and charges for the use of water by homeowners, businesses and small farmers at rates of about $0.77 per 1,000 gallons. Rate increases to be implemented in the future.

In times of drought and increasing population it is difficult for the Board to provide enough water to those who want it. They must charge more and more for the water to discourage excessive use. They do not have any control over the 60% of water the sugar growers use or the 7% used by the military, or the 7% used in privately developed systems.

From its beginnings in 1920 to the present, the Board has had increasing difficulties meeting demand for water. The head level of water in 1880 was 42 feet; in 1946 it was 21 feet; in 1973 it was 17 feet. At present the public is using about 450 million gallons of water per day. The Board feels that about 510 million gallons per day could be developed, but they have no control over the use of water by sugar industry, or military. SB 2020 gives the new board control over all the water.

Further, you point out that if the water use is not regulated by one board, Hawaii may soon have to turn to desalination. The costs for this are high. Desalination of brackish water would cost about $1.50 to $2.50 per 1,000 gallons. Desalination of sea water would cost $3.00 to $4.00 per 1,000 gallons. In addition, the energy to operate the desalination plants would have to come from burning oil. Oil is becoming scarce and expensive.

You urge that a decision must be made to regulate the sugar industry's use of water so there is enough for the urban population. Point out that perhaps the time for growing sugar in Hawaii is past. Perhaps the land should be used for people.

The sugar industry will have to make some adjustments. They will have to pay for their water or they may use sewage effluent from the sewage treatment plants, thus solving another environmental problem.

You may wish to base your testimony on:

1. Amount of water currently regulated compared to controlling all the water proposed in SB 2020.
2. Costs of developing other ways of getting water.
3. Use of sewage effluent as an alternative for the sugar industry.
4. The use of water for the good of the majority of people not just the sugar industry.
5. Other arguments you can think of.

SMALL FARMERS

Your group is in favor of the bill in general but against certain sections of it.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. I represent a group of small farmers on Oahu. I speak in favor of the SB 2020 with some reservations. (Give your testimony. Show your visual aids.) We recommend the following actions be taken on SB 2020. (Give your recommendations.)

Small Farmers Information

The small farmers are in favor of SB 2020 because they have been deprived of water for the last 100 years. First the sugar planters tapped the water sources and diverted them for growing sugar. Then more recently the Board of Water Supply did the same thing to get water for home use. As a result stream flow has been reduced and in some cases has dried up completely. In addition small farmers are charged for water they use while sugar growers get their water free. They feel that if water was all owned by the public and controlled by the new proposed Board of Water Management, they would have a better chance of getting the water they need at a reasonable cost.

As small farmers, you want water more freely available to encourage more kinds of agriculture in Hawaii. You believe the farmers should be self-sufficient and not rely on subsidies from the government the way the sugar growers do. You believe that farming is a way of life that more people should get back to. In order to do that, water is needed. Without the availability of water the land is useless, and no food crops can be grown.

The small farmers are against the section of the bill stating that the members of the proposed Board are to be appointed by the Governor. They are afraid that the powerful sugar industry will exert pressure on the Governor to appoint members who will continue to favor the sugar industry with free or inexpensive water. They want an elected Board and standard rates of water use for all agriculture.

You may wish to base your testimony on:

1. The need for water to raise food other than sugar.
2. The control of water to ensure a fair share for all.
3. A position against <u>appointed</u> Board members.
4. Cheaper water rates for farmers than homeowners or industry.
5. Other arguments you can think of.

HOMEOWNERS ASSOCIATION

Your group is in favor of SB 2020.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group, present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____ My name is _____. I represent the Homeowners Association of Hawaii. I speak in favor of the SB 2020. (Give your testimony. Show your visual aids.) We recommend the following action be taken on SB 2020. (Give your recommendations.)

HOMEOWNERS INFORMATION

As homeowners, your group is very concerned about the rising cost of water. You know that the Board of Water Supply regulates the water you use and charges you for its use. The Board has raised the rates for water use twice in the last 2 years and is currently proposing another rate increase for next year. You used to pay 30¢ per 1,000 gallons of water. Now you pay 77¢ for 1,000 gallons. With the proposed increase you will be asked to pay 85¢ per 1,000 gallons.

In the past few years the Board of Water Supply has been asking homeowners to conserve water. Yet you know that the sugar planters have not been using less and they get their water free of charge. Why should homeowners pay for water and others get it free?

You believe that the water should be declared a public resource so that it can be regulated by government. This will ensure that there is enough water for everyone at a fair price. If sugar growers and others take what they want without controls, who will make sure people have enough to drink, to bathe, to grow lawns and for recreation? Who will be sure there is enough water for new housing developments and for the next generations?

Further, you are aware that water is needed to keep the environment green, to prevent costly fires in the environment. You feel that keeping the environment green and beautiful is important to Hawaii, perhaps as important as the jobs and money produced by the sugar growers.

You may wish to base your testimony on the following:

1. Unfair charges for water for some but not for others.
2. Water should be a public resource to be used and enjoyed by everyone.
3. Government should take steps to be sure there is enough water for all who need it.
4. Beauty and natural ecosystems are just as important to living in Hawaii as agriculture.
5. Other arguments you can think of.

ENVIRONMENTALISTS

Your group is in favor of SB 2020.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group, present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. My name is _____. I represent This Is Our Land, a non-profit group of citizens concerned about our environment. We speak in favor of SB 2020. (Give your testimony. Show your visual aids.) We recommend the following action be taken on SB 2020. (Give your recommendations.)

ENVIRONMENTALISTS INFORMATION

As people concerned about caring for all parts of the environment you are very interested in this water issue. You believe water ought to belong to all the people to share equally, not just to the few who have money and machines to take the water. You are in favor of having water declared a public resource which all people have a right to share.

Urge that all uses of water ought to be considered; sugar, agriculture, small farmers, urban use, beauty, maintaining natural environments, recreation, swimming, industry, etc... Only when one Board controls all the water resources can all get their fair share. Point out that the declaration of water as a public resource controlled by one Board does not mean people will not have rights to it. It means that all people will have rights to the water, perhaps even free of charge. The Board may choose to set rates for some and not charge others for the water they use. But most importantly the Board will be able to set limits on what can be done with the water and how much different groups can use.

You strongly feel that water belongs to everyone. Government cannot go on letting big users take what they want away from the little users.

You disagree with the Board of Water Supply. They say 510 million gallons of water can be developed on Oahu. They also say that there is plenty of water until the year 2000. Your researchers say that the water supplies are much lower than that and Oahu will run out of water in the 1980's. You want action taken now to prevent that from happening. Besides you don't want all the water to be used for development. Instead it should be used to keep Hawaii beautiful. Some should also be saved for future generations.

Perhaps the people should look at recycling water. Why can't sugar growers use sewage effluent? The effluent would percolate through the soil and be cleaned at the same time adding nutrients. Perhaps sugar cane should be phased out in favor of preserving the natural environment.

You may wish to base your testimony on:

1. Preserving nature and water.
2. Giving everyone equal shares of water.
3. Government responsibility to protect all its people and its resources.
4. Water is the most important resource. Without it the land is useless.
5. Other arguments of your own.

THE MILITARY

Your group is against SB 2020.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group, present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. My name is_____. I represent the Armed Forces of the United States. We are here today to speak against SB 2020. (Give your testimony. Show your visual aids.) We recommend the following actions be taken on SB 2020. (Give your recommendations.)

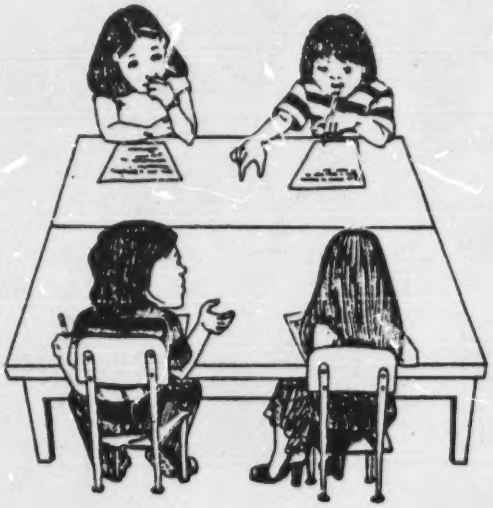
MILITARY INFORMATION

Your concern deals mostly with 1) the investment the Federal Government has made already in developing water systems in Hawaii and 2) with maintaining security of military bases. In 1883 the United States gained its first military interest in Hawaii when Pearl Harbor was signed over for its exclusive use. The military developed the area and later acquired many other areas for bases. In the 1940's the military built its own water shaft at Red Hill to get water for its bases. Thus, there has been a substantial investment of money.

More importantly you believe that it is of utmost importance that the military continue to obtain and control its own water to be safe from threats from other countries or saboteurs. If the city water supply is interrupted or even poisoned, the military will still be able to get its water and protect the Islands. Point out that at present, the military controls only about 7% of the water; a small price to pay for national security.

You may wish to base your testimony on the above information, or on arguments of your own.

ECONOMISTS



Your group is against SB 2020.

Prepare your testimony using the information on the back of this page. Find out what the time limit is.

Prepare at least one visual aid to support your testimony.

Choose a speaker or speakers for your group. When the Chairperson of the Committee calls on your group present your testimony. You might begin by saying:

Thank you Mr., Mrs., or Miss _____. My name is _____. I have been asked by the State Economic Department to testify here today. I am speaking against SB 2020. (Give your testimony. Show your visual aids.) We recommend that the following action be taken on SB 2020. (Give your recommendations.)

ECONOMIST INFORMATION

There are several economic questions involved in the water issue. You note that if SB 2020 is passed as written it is very likely that the sugar growers will have to pay for water they currently get for free. You point out that the sugar industry is not very strong since it is receiving government subsidies in order to keep the price of its sugar competitive on the open market. The industry employs over 9,000 people and contributes over $300 million each year to the State's economy. If sugar growers have to pay for water it may drive them out of business resulting in unemployment. Point out that not only would the State lose the income, but that it would have to support the unemployed. You might also point out that no other crop can be grown so extensively in Hawai'i as sugar cane.

Economically you believe that it is better to continue with the current water regulation structure. The Board of Water Supply can regulate water to homeowners and small farmers and encourage conservation by charging higher rates. By charging more, people will use less. Then there will be enough water for everyone.

If that is not sufficient, salt water can always be desalinated. The cost will be higher, but people will use less. Desalination of brackish water would probably cost $2.50 per 1,000 gallons. Desalination of sea water might cost as much as $4.00 per 1,000 gallons. Current rates are about .77 per 1,000 gallons.

You believe sugar cane industry and small farming operations are good use of the land and water. The water can be recycled and with careful attention to run off, much of it can percolate back into the ground to be used again. Agriculture provides jobs and income which benefit the total economy of the State.

You may wish to base your testimony on:

1. The importance of agriculture to the industry.
2. Use of higher water rates to make people conserve.
3. Other arguments you can think of.

WATER REGULATION: WHAT ALTERNATIVES

DIGEST

I. PREPARATION

Arrange to have sufficient activity sheets class.

1 for each student - Activity sheets 6.2, SB 2020
1 for each group - Activity sheets 6.2A, 6.2B, 6.2C, 6.2D, 6.2E, 6.2F, 6.2G, 6.2H

VOCABULARY

mock
legislative
economists
environmentalists
testimony

II. STUDENT ACTIVITIES

Project: Prepare and hold a mock legislative committee hearing on water control.

A. Distribute activity sheet 6.2 and Senate Bill 2020.
B. Discuss what is to be done in the mock legislative hearing.
C. Divide the class into 8 groups.
D. Hand out group sheets.
E. Prepare and arrange for the mock hearing. Prepare visual aids.
F. Call the hearing to order. Hear the testimony. Keep the visual aids posted.
G. Have the Senate Committee decide the future of the bill and announce their decision.

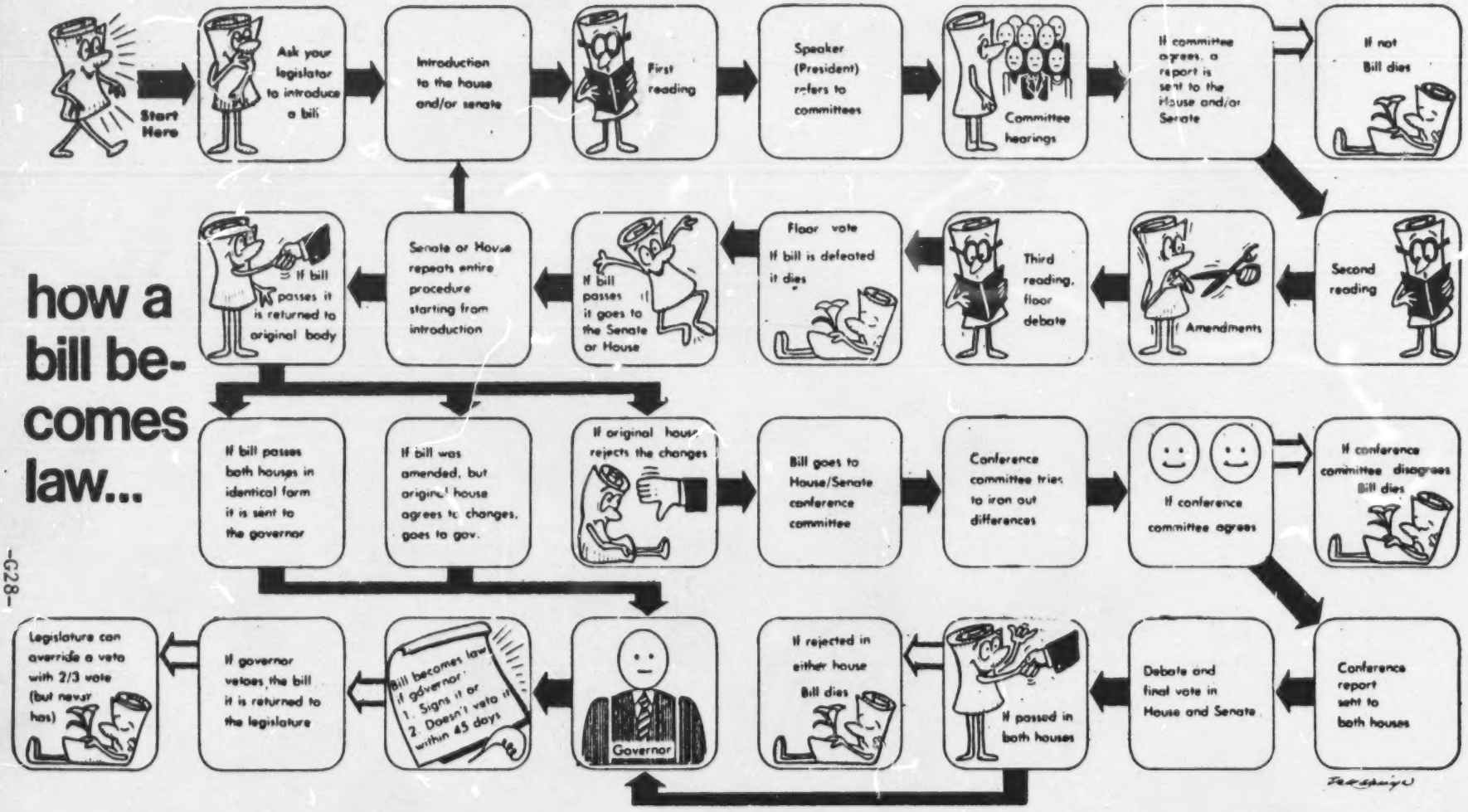
III. SUMMARY

Point out that there are many interest groups who have different points of view on environmental matters.

Note that environmental decision making is complex. There are no easy solutions.

Sunday Star Bulletin-Advertizer
January 21, 1979

how a bill becomes law...


Start Here
Ask your legislator to introduce a bill
Introduction to the house and/or senate
First reading
Speaker (President) refers to committees
Committee hearings
If committee agrees, a report is sent to the House and/or Senate
If not Bill dies
Second reading
Amendments
Third reading, floor debate
Floor vote
If bill is defeated it dies
If bill passes it goes to the Senate or House
Senate or House repeats entire procedure starting from introduction
If bill passes it is returned to original body
If bill passes both houses in identical form it is sent to the governor
If bill was amended, but original house agrees to changes, goes to gov.
If original house rejects the changes
Bill goes to House/Senate conference committee
Conference committee tries to iron out differences
If conference committee agrees
If conference committee disagrees Bill dies
Conference report sent to both houses
Debate and final vote in House and Senate
If passed in both houses
If rejected in either house Bill dies
Governor
Bill becomes law if governor 1. Signs it or 2. Doesn't veto it within 45 days
If governor vetoes the bill it is returned to the legislature
Legislature can override a veto with 2/3 vote (but never has)

-C28-

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Section 7

Projects and Follow-up

Instructional Goals

When faced with decisions concerning the use of terrestrial and extraterrestrial resources, students will select practices developed in recognition of present future environmental and human needs.

Students will demonstrate their awareness and knowledge of population processes and dynamics.

Students will examine optional courses of action and their consequences for improving the quality of life and will support those that will provide optimum short-and long-term benefits for society and the environment.

Instructional Objectives

Design a dramatic production to illustrate the dependence of plants and animals upon water as a resource. Sc, LA, N

Identify individual and community practices that affect quality of both fresh and marine water resources. Sc, SS, H

Collect and report data demonstrating the effects of imported plants and animals on Hawaii's environment. Sc, SS, LA, HS, LS

Describe some aspect of life in Hawaii that has changed in the last two hundred years and relate this change to population changes. SS, LA, HS, C

Suggest ways people may be influenced to more completely appreciate and protect their environment. SS, Sc, PE, PE, Art, Music, V

Group sounds from several locations as natural or human-made, pleasant or unpleasant. Sc, H, Music

Make a musical presentation representing a particular type of environment or a component of an environment. Music

Identify components of a familiar environment from their characteristic sounds. Music

Observe and describe the steps that are necessary to produce potable water at the faucet in the home. Sc, SS, H

Performance Expectations

Uses a variety of resources to gain information on environmental matters.

Communicates feelings evoked by various types of environments.

Describes the need for beauty in one's environment.

Lists a number of environmental factors which may affect the emotional or physical health of human beings.

Identifies specific contributions one can make to help human beings live in harmony with the environment.

Essential Competencies

Use resources for independent learning.

Section Objectives

Become involved in environmental projects.

Listen to various representations of water that demonstrate creative expression through music.

Develop an awareness of the aesthetic qualities of water in the environment.

WATER - IS OUR SUPPLY RUNNING OUT?

I. QUESTION

Could any of the Hawaiian Islands actually run out of potable water? If so, what would the effects be on people and the environment?

II. ACTIVITY

Discuss what would happen if the water supply in your community or island disappeared. How would you and your family be affected? What about plants, animals, industry etc.?

A study of the water supply on your island could be useful to everyone who lives there. Research the water supply on your island and make a documentary on your findings to present to the rest of the school, community groups, or governmental organizations.

You will need to find information on the following questions:

- Where does the water come from?
- How much water is readily available?
- What groups use the water and for what purpose?
- How much of the available water supply is used by each group?
- Has your island ever had a water shortage? If so, when?
- Have certain recreational, agricultural, or industrial activities been reduced or eliminated because of limited or polluted water supplies?
- Are there pollution problems on your island? What are the causes of these problems? Is anything being done about these problems?
- What water conservation activities are occurring on your island? Are future activities planned?
- What is being done to increase the available water supply on your island? What, if any, future activities are planned?

- How would a prolonged drought affect your island's water supply?

- How would a limited water supply affect individual lifestyle, industry, agriculuture, business and the environment?

- What can individuals do to insure adequate water supplies in the future?

Things To Do

Organize your groups. Look at professional documentaries on television and in reports. Decide who will collect information, do water quality experiments, take pictures, make charts, posters and graphs, write scripts and interview various "experts" in water resource management and pollution control.

Build the first part of your report on the present status of your island's water supply. Try to find out if there are any projections for the future of the water supply and plans to insure an adequate supply.

Highlight any present or possible future water supply problems. Recommend actions for solving or preventing those problems. Project the impact of those solutions on present and future generations and on the environment.

Decide how best to present your documentary. Displays, audiotapes, slide shows, movies, videotapes, plays and skits all may be used.

When your documentary is complete, present it to other school classes, community groups such as P.T.O., business groups, or government organizations.

Present your story to the local newspaper, radio or television station or ask local merchants, companies or libraries for display space to tell your story. Invite parents and community persons to your classroom for a presentation.

WATER - IS OUR SUPPLY RUNNING OUT?
DIGEST

I. PREPARATION

Elicit discussion about an imaginary waterless community. What would it be like? Then relate this to your island. Where would the shortage be felt first? What group or industry would be most seriously affected? What would happen next?

VOCABULARY

disaster
emergency
documentary

II. STUDENT ACTIVITIES

As the lesson begins, try to guide and extend the discussion to a hypothetical island without water, until the long-range effects emerge. Use your own imagination and enthusiasm to formulate provocative questions, and let the children ramble until they begin to see the implications of the idea of a world without water.

Students will make a documentary.

III. SUMMARY

By researching for the documentary and by working together, students can arrive at a better understanding of the condition of the local water supply.

This is a culminating activity. It is hoped that the class will think of many other interesting activities. Alternative activities might include:

1) publish a monthly environmental newsletter
2) establish groups to be responsible for making and displaying environmentally-oriented posters throughout the year
3) establish a school Environmental Council
4) establish awareness committees to collect and report on current environmental questions that appear in newspaper and magazine articles.

WATER - IS OUR SUPPLY RUNNING OUT?

NOTES

Under Activity: Help students compile a list of local services that will be useful to them. Identify materials they can collect from public agencies. Certain field trips may be useful for the whole class; some field work can be done by individuals. Help, but don't collect all the information yourself. Let them do it. If they want to sample and test water, ask the high school chemistry teacher or the water company for help.

Under Things to Do: Making movies is fun and good for children. The high school athletic department may have a camera, or a parent might be "hired" on a volunteer basis.

Children can make snapshots with still camaras. (For interesting information about children's use of still camaras, write to the Eastman Kodak Company's Visual Literacy Program.)

You may be able to get additional pictures for your class documentary from the Chamber of Commerce, city departments of water and sanitation, and state and local offices of water pollution control.

To present the documentary, contact local media well ahead of the time you want to present your documentary. Lead time is important to them. They may also give format advice and technical help. Let the students do some of the contacting. They are great salesmen!

The making of a documentary, suggested in this lesson, can become an integrated social science, science, language arts, and art project.

In the planning stages, you should keep the scope of the project within the limits of practicality without stifling the ingenuity of the students.

During the planning sessions, try to manipulate the work assignments so that every child participates in a way that is likely to be successful to him or her. There will be many opportunities to use some of the skills that certain of your students already have. New skills can be learned by some of the children as they are needed. Each child can contribute something. The tasks can be individualized, and no one will need to feel that he or she is competing against everyone else. Information developed by one group of students can be shared with the rest. The group experience can be one of both learning and teaching in a comfortable atmosphere.

The ideas given in Activity 7.1 are designed to suggest possibilities, not to lay down a hard-and-fast blueprint. The important objective is that the youngsters learn something about the use and conservation of water, the problems of cooperating on a project, and the pride of accomplishment.

Don't be afraid to ask for help when you need it. You may need to borrow equipment from the high school science department, expertise from community scientists and technicians, and cooperation from the community public utilities and media. Besides contributing to the project, these associations can indirectly teach your children a great deal about adult social roles and the nature of the community.

If your students have shown a great deal of interest and ingenuity in making a documentary, then they might want to wind it up with a look at the future, projected along lines suggested by their own interviews with local officials. There might even be one or two students interested in roughing out a skeleton of a sequel, based on this projection and the possible alternative futures it may suggest for your local community and the region it is part of.

This list can be short or very complete, depending on the interest of your class. Sometimes a class will become so involved with one particular possible course of action that the youngsters prefer to develop this one in detail rather than make a long list.

CAN YOU HEAR A SCENE?

I. QUESTION

Can you picture a scene created in a musical composition?

II. DISCUSSION

Musical composers often try to imitate in sound everyday sights and experiences they see or hear in their environment. Compositions such as Bedřich Smetana's "The Moldau", Ottorino Respighi's "The Fountains of Rome", Paul Winter's "Callings", and Ferde Grofé's "Grand Canyon Suite" are good examples of the composers' musical descriptions of their impressions of a particular environment.

III. WHAT TO DO

Listen to one of these compositions. Try to picture the story the composer attempts to convey. Discuss the mood, ideas, instrumentation, and musical form utilized.

How many different scenes are pictured in the composition? What moods are created by the music? Do the scenes represent different places or the same place at different times of the day or in different seasons? Are the surroundings pictured in the composition natural, made by humans, or both? How are animals or people depicted in the music? What forces of nature are represented?

How are instruments used to represent the different components of the scenes suggested by the music? What instruments perform the main musical themes in the different sections? What special techniques such as repetition, melodic contour, dynamics, harmonic structure, etc., were used in the composition?

Write a detailed description of one of the sections in the composition.

ADDITIONAL ACTIVITIES

Use another art form--drama, poetry, dance, or art to recreate one or more of the sections in the musical composition.

CAN YOU HEAR A SCENE?

DIGEST

I. PREPARATION

Arrange to have a recording of one of the following:

Bedřich Smetana's	"The Moldau"
Ottorino Respighi's	"The Fountains of Rome"
Paul Winter's	"Callings"
Ferde Grofé's	"Grand Canyon Suite"

II. STUDENT ACTIVITIES

Introduce the idea of scenes from the environment being depicted in a musical composition.

Play one of the recordings. Have students try to picture the scenes depicted in various sections of the composition. Discuss the sections and what techniques such as repetition, melodic contour, dynamics, harmonic structure, etc., were used by the composer to transmit the musical pictures.

How many different scenes were pictured in the composition? What moods were created by the music? Have the students describe at least some of the scenes. Were they in different places or in the same place at different times of the day or in different seasons? Are the surroundings in the composition natural, made by humans, or both? How are animals or people represented in the music? What forces of nature (winds, waves, etc.) are represented?

How are instruments used to represent the different components of the scenes suggested by the music? What instruments perform the main musical theme in each section? What special techniques were used in the composition?

III. SUMMARY

Listen to the composition again. Have students write a detailed description of one of the sections in the composition.

ADDITIONAL ACTIVITIES

Use another art form--drama, poetry, dance, art, etc., to recreate one or more of the sections in the musical composition.

The Voices of Water

I. Question

How many different ways can you "hear" water?

II. Discussion

Think of the many times that you have heard the sound of water--raindrops on roofs or pavement, running water in sink or tub, moving water in streams or waves. How does it sound? How does it make you feel?

III. Things To Do

Individually or in small groups use a tape recorder to record various voices (sounds) of water. As you record each sound, keep a record of where and when (day and time) you recorded it and what action of water caused the sound. Identify any other sounds which you may have heard at the same time.

Play these recordings for the rest of the class. Have them guess what the water is doing and any other details that can be identified by the sounds. Discuss the accuracy of their answers and describe the scene in which the sounds occurred.

Perform one or more of the following activities.

Try to imitate the voices (sounds) of water in your recordings using your own voice or a musical instrument.

Select one or more of the voices of water and develop a musical composition to represent the scene(s) in which the sound was created.

Represent one or more of the voices of water you recorded in a work of art--painting, ceramics, etc.

Write a poem describing one or more of the voices you recorded.

Develop a skit or play based on one or more of the voices you recorded. For example, you might describe the odyssey (journey) of someone seeking the pot of gold at the end of a rainbow and encountering the many voices of water along the way.

Develop a dance based on one or more of the voices of water in your recording. Hint: Observe how dancers represent rain, waves, waterfalls etc., in the movements of the hula.

THE VOICES OF WATER

DIGEST

I. PREPARATION

Equipment needed:

One or more tape recorders and several audiotapes. If only one recorder is available, the teacher may wish to divide the class in small groups and let each group make a recording over a period of several days. However, many families now have small tape recorders and students may volunteer to do this activity as a home assignment. (This is a good opportunity to stimulate parental interest.)

Other equipment and supplies needed will depend on the which activities are selected under "Things To Do".

II. STUDENT ACTIVITIES

Have students record various sounds of water. Be sure to instruct them to keep a record of where and when they recorded it, what action of water caused the sound and any other sounds that might have been recorded at the same time.

Have each group play their recordings for the rest of the class. Have the class guess what is happening to the water and any other details which can be identified by sounds alone. Discuss the accuracy of their answers and have the recording group describe the scene in which the sounds occurred.

Select the most interesting of the recordings and have students perform one or more of the following activities according to their interest, abilities, and available materials and equipment.

Imitate the voices of water in the recordings using their voices or musical instruments.

Select one or more of the voices of water and develop a musical composition to represent the scene (s) in which the sounds were created.

Represent one or more of the voices of water recorded in works of art--painting, ceramics, etc.

Write a poem describing one or more of the voices recorded.

Develop a skit or play based on one or more of the voices recorded. For example, students might describe the odyssey of someone seeking the pot of gold at the end of a rainbow and encountering the many voices of water along the way.

Develop a dance based on one or more of the voices of water in the recordings. Hint: Observe how dancers represent rain, waves, waterfalls, etc., in the movements of the hula.

BIBLIOGRAPHY

1. "Ecosystems," Science Curriculum Improvement Study. Rand McNally & Company, 1971.

2. Essence. Addison-Wesley Co, California, 1971.

3. Exploring Nature in Hawaii, Book V. Sister Mary St. Laurence, O.P., Tongg Publishing Co, HOnolulu, 1962.

4. FAST 1: Foundational Approaches in Science Teaching. Curriculum Research & Development Group, University of Hawaii, Honolulu, 1978.

5. Ginn Science Program - Intermediate Level C. Asimove, Issac, Roy Gallant. Ginn & Company, 1973.

6. Inquiring About Technology. Wm. R. Fielder, Ed. Holt, Rinehart and Winston, Inc., New York, 1972.

7. Modular Activities Program in Science. Berger, Carl, Glenn Berkheimer, L.E. Lewis, Harold Neuberger, Elizabeth Wood. Houghton Miffin Company, Boston, 1974.

8. NEED - Adventure in Environment. National Park Foundation, Silver Burdett, Palo Alto, 1972.

9. STEM - Elementary School Science, Levels 4, 6. Verne N. Rockcastle, Frank Salamon, Victor Schmidt and Betty J. McKnight. Addison-Wesley Company, California, 1975.

10. The Social Sciences - Concepts and Values. Brandwein, Paul, Nancy Bauer, Daniel Daly. Harcourt Brace Jovanovich, Inc., New York, 1970.

11. Water Pollution. Lavaroni, Charles W., Patrick O'Donnell, Lawrence Lindberg. Addison-Wesley Company, California, 1971.

12. Windows on Our World - The Way People Live. Margaret Stimmann Bramson, Houghton-Mifflin Co., Boston, 1976.

APPENDIX

AGENCIES AND ORGANIZATIONS CONCERNED WITH WATER

RESOURCE MANAGEMENT AND PROTECTION

FEDERAL

Environmental Protection Agency
Office of Federal Activities (A-104)
401 M Street, S.W.
Washington, D. C. 20460

Fish and Wildlife Service
Department of the Interior
Washington, D. C. 20240

Interstate Commission on the Potomac River Basin
814 East West Towers
4350 East West Highway
Bethesda, MD 20014

National Institute of Environmental Health Services
National Institutes of Health
Public Health Service
Department of Health and Human Services
Bethesda, MD 20014

National Sea Grant Program
National Oceanic and Atmospheric Administration
Department of Commerce
3300 Whitehaven Street, N. W.
Washington, D. C. 20235

Office of the Assistant Secretary for Health
Department of Health and Human Services
Washington, D. C. 20201

Office of Environmental Education
Department of Education
400 Maryland Avenue, S. W.
Room 2025
Washington, D. C. 20202

U. S. Army Corps of Engineers
Department of the Army
Office of the Chief of Engineers
Washington, D. C. 20314

Office of Coastal Zone Management
National Oceanic and Atmospheric Administration
Department of Commerce
3300 Whitehaven Street, N. W.
Washington, D. C. 20235

Soil Conservation Service
Department of Agriculture
Washington, D. C. 20250

Tennessee Valley Authority
Norris, TN 37828

United States Water Resources Council
Suite 800
2120 L Street, N. W.
Washington, D. C. 20037

U. S. Department of the Interior
Washington, D. C. 20240

STATE

COUNTY OF HAWAII

Department of Agriculture
75 Aupuni Street
Hilo, HI 96720
Telephone: 961-7361

Department of Health
Air Water Pollution Control
191 Kuawa Street
Hilo, HI 96720
Telephone: 961-7551

Department of Health
Air Water Pollution Control
Kealakekua, HI 96750
Telephone: 322-9331

Department of Land and Natural Resources
Conservation Hotline
Telephone: Enterprise 5469

Division of Water and Land Development
Hilo, HI 96720
Telephone: 961-7279

Kamuela, HI 96743
Telephone: 885-7037

COUNTY OF HAWAII

Department of Public Works
Sewers and Sanitation Bureau
Telephone: 961-8338

Water Supply Department
25 Aupuni Street
Hilo, HI 96720
Telephone: 935-1127

STATE

COUNTY OF KAUAI

Department of Agriculture
Telephone: 245-4411

Department of Health
3040 Umi Street
Lihue, HI 96766
Pollution Control
Telephone: 245-4323

Department of Land and Natural Resources
Conservation Hotline
Telephone: Enterprise 5469

Division of Water and Land Development
Telephone: 245-4444

COUNTY OF KAUAI

Public Works Department
Division of Sewers and Drainage
Telephone: 245-4751

Water Department
Telephone: 245-6986

STATE

COUNTY OF MAUI

Department of Agriculture
Telephone: 244-4229

Department of Health
Environmental Pollution
Telephone: 244-4228

Department of Land and Natural Resources
Conservation Hotline
Telephone: Enterprise 5469

Division of Land Management
Telephone: 244-4352

COUNTY OF MAUI

Department of Public Works
Sewers Division
Telephone: 244-7773

Water Supply Department
Telephone: 244-7835

Water Quality
Telephone: 877-0275

STATE

OAHU

Department of Agriculture
1428 South King Street
Honolulu, HI 96814
Telephone: 548-2211

Environmental Quality Control
550 Halekauwila Street
Honolulu, HI 96813
Telephone: 548-6915

Department of Health
1250 Punchbowl Street
Honolulu, HI 96813
Telephone: 548-6505

Pollution Investigation
and Enforcement Branch
645 Halekauwila Street, 2nd Floor
Honolulu, HI 96813
Telephone: 548-6355

Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, HI 96813
Telephone: 548-6550

Water and Land Development Division
Telephone: 548-7539

Department of Planning and Economic Development
Kamamalu Building
250 South King Street
Honolulu, HI 96813
Telephone: 548-4025

Aquaculture Development Program
Telephone: 548-5495

University of Hawaii
Honolulu, HI 96822
Telephone: 948-8111

Aquarium
Telephone: 923-4725
Environmental Center
Telephone: 948-7361
Water Resources Research Center
Telephone: 948-7847

HONOLULU CITY AND COUNTY

Board of Water Supply
635 South Beretania Street
Honolulu, HI 96813
Educational Materials and Tours of Facilities
Telephone: 548-6124, 6126

Department of Land Utilization
650 South King Street
Honolulu, HI 96813
Telephone: 523-4414
Flood Hazard Districts
Telephone: 523-4247

Department of Parks and Recreation
650 South King Street
Honolulu, HI 96813
Telephone: 523-4181
Water Safety
Telephone: 922-3888

Department of Public Works
650 South King Street
Honolulu, HI 96813
Chief Wastewater Management Division
Telephone: 523-4321

NON-GOVERNMENTAL ORGANIZATIONS

American Forest Institute, Inc. (The)
Project Learning Tree
1619 Massachusetts Avenue, N. W.
Washington, D.C. 20036
Telephone: (202) 797-4530

Life of the Land
250 S. Hotel Street, Rm. 211
Honolulu, HI 96813
Telephone: 521-1300

National Wildlife Federation
1412 16th Street, N.W.
Washington, D.C. 20036
Telephone: (202) 797-6800

Education Division
8975 Leesburg Pike
Vienna, VA 22180
Telephone: (703) 790-4353

Sierra Club
530 Bush Street
San Francisco, CA 94108
Telephone: (415) 981-8634

Sierra Club Hawaii Chapter
1212 University Avenue
Honolulu, HI 96826
Telephone: 946-8494

Annotated List of Journals and Magazines

AQUATIC BOTANY is an international scientific journal dealing with applied and fundamental research on submerged, floating and emergent plants in marine and fresh water ecosystems. Elsevier Scientific Publishing Co., Box 211, Amsterdam, Natherlands (Elsevier North-Holland, Inc., New York 52 Vanderbilt Avenue, New York, N. Y. 10017).

CALYPSO LOG DISPATCH is the publication of the Cousteau Society and presents a variety of articles dealing with marine and aquatic environments. Calypso Log, The Cousteau Society, Inc., 8430 Santa Monica Boulevard, Los Angeles, CA 90069.

CHESAPEAKE SCIENCE is a regional journal of natural resources. Topics of articles include pollution, ecology, flora and fauna, and geology. University of Maryland Center for Environmental and Estuarine Studies, Chesapeake Biological Laboratory, Solomons, MD 20688.

CURRENT ENERGY AND ECOLOGY is an environmental education magazine suitable for upper elementary through intermediate school students. Each issue presents information on a variety of environmental topics. Published monthly during the school year. Curriculum Innovations, Inc. 501 Bank Lane, Highwood, IL 60040.

DELAWARE CONSERVATIONIST is issued quarterly by the Delaware Department of Natural Resources and Environmental Control, Dover, DE 19901. The magazine has articles on all aspects of Delaware's environment: wetlands and other habitats, recreational areas, geology, flora, fauna, and history.

ECOLOGY deals with all forms of life in their relation to the natural environment. Subjects include ecology, pollution, flora, and fauna. C. G. Jackson, Jr., Editor, San Diego Natural History Museum, Post Office Box 1390, San Diego, CA 92112.

JOURNAL OF WATER POLLUTION CONTROL FEDERATION provides technical data and reports on various aspects of water pollution and is an excellent source of facts and figures. 3900 Wisconsin Avenue, N. W., Washington, D. C. 20016.

NATIONAL GEOGRAPHIC is the publication of the National Geographic Society dealing with all aspects of the universe. Articles and photography deal with flora and fauna, ecology, and humans effects on the natural system. National Geographic Society, Seventeenth and M Streets, N. W., Washington, D. C. 20036.

NATIONAL WILDLIFE is a bi-monthly publication of the National Wildlife Federation dealing with preservation and management of the natural environment. 1412 16th Street, N.W., Washington, D.C. 20036.

NUTRITION TODAY is a bimonthly publication of the Nutrition Today society and contains numerous articles on nutrition and the relationship of nutrition and environment. Nutrition Today, Inc., 703 Giddings Avenue, Post Office Box 1829, Annapolis, M. D. 21404

RANGER RICK'S NATURE MAGAZINE is geared to the young reader with excellent introductory articles on all aspects of nature. National Wildlife Federation, Attention Subscription Department, 1412 Sixteenth Street, N. W., Washington, D. C. 20036

SIERRA CLUB BULLETIN is the journal of the Sierra Club with articles dealing with environmental conflicts. Topics include endangered species, pollution, and utilization of resources.

SOIL CONSERVATION is the official magazine of the Soil Conservation Service and contains a variety of articles related to protection and conservation of the land. Published monthly. Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

WATER RESEARCH is a monthly journal containing papers concerned with the effects of waste water on the environment through analysis by chemical, biological and physical means. Pergamon Press, Maxwell House, Fairview Park, Elmsford, N. Y. 19523.

Annotated List of Newletters, Bulletins, and Paper

AIR/WATER POLLUTION REPORT, Business Publishers, Inc., Box 1067, Blair Station, Silver Spring, MD 20910. Published weekly. News about environmental pollution: its occurrence, relevant acts and laws, products for pollution control, and methods taken for controlling pollution.

AQUANOTES, Office of Sea Grant Development, Louisiana State University, Baton Rouge, LA 70803 Published five times a year. Free Information and news about Louisiana's wetland resources, Sea Grant Activities, related topics.

ENVIRONMENT REPORTER, Bureau of National Affairs, Inc., 1231 25th Street, N.W., Washington, D. C. 20037. Published weekly. Current events relating to pollution and its control are related, usually by area or State. Pertinent laws, meetings and contract awards and grants are cited.

EPA CITIZEN'S BULLETIN, U. S. Environmental Protection Agency, Washington, D. C. 20460. Published monthly. News about activities and events relating to and affecting the environment and methods taken to controls or prevent activities harmful to the envrionment.

GREAT LAKES NEWS LETTER, Great Takes Commission, Institute of Science and Technology Building, 2200 Bonisteel Boulevard, Ann Arbor, MI 48105. Published bi-monthly. News about activities of the Commission and other activities pertaining to the Great Lakes. Current references to pertinent publications appear regularly.

POLLUTANT IDENTIFICATION RESEARCH HIGHLIGHTS, Southwest Environmental Research Laboratory, Environmental Protection Agency, College Station Road, Athens, GA 30601. Irregular. News items about current research in pollutant identification.

SPORT FISHING INSTITUTE BULLETIN, 608 23th Street, N.W., Washington, D.C. 20005, Suite 801. Analyzes and evaluates research in fishery science, aquatic ecosystems management and related matters in both fresh and salt water systems. Published bi-monthly.

WATER NEWSLETTER, Water Information Center, Inc. 44 Sintsink Drive, East, Port Washington, Long Island, N. Y. 11050. Published twice a month Information about water supply and conservation and waste disposal as it relates to water.

WETLANDS INSTITUTE NEWSLETTER, The Wetlands Institute, Box 91, Stone Harbor, N. J. 08247. Relates the activities of the Institute, which is sponsored by Lehigh University.

WORLDWATCH PAPERS are a series of papers issued by the Population Reference Bureau on a variety of topics related to the environment and population. Population Reference Bureau, Box 35012, Washington, D. C. 20013

AUDIOVISUAL MATERIALS

FILMS

The following films are available from the Office of Instructional Services, Multimedia Services Branch. Consult the 16 mm Film Catalog for further information.

WATER

1249 "Honolulu's Unusual Water Supply": 18 min., E-A H
Discusses the geologic formation of Oahu, its bearing on water supply and the role of the Honolulu Board of Water Supply.

5123 "Psychedelic Wet": 8 mins., E-H C A
Presents an impressionistic view of water. Views reflections on the ceiling of the sea off the Bahamas, a pretty girl in a pool and great waves off the north shore on Oahu, Hawaii.

3088 "The Water Cycle": 11 mins., E-J
Describes the continuous circulation of water from earth to sky and back to earth. Examples of evaporation, condensation, precipitation, storage and runoff are given.

7037 "Water Follies": 7 min., P-H C A T
Excellent film on water conservation, excessive uses of water are depicted. Very effective way of showing water conservation techniques in the home.

3089 "Water for the Community": 11 min., E-J
Describes the source of a community's water supply, and tells how the water is treated from the time it leaves its source until it is purifed and distributed in the community.

4795 "Water Supply": 11 min, E-J
Shows how water for both rural and urban communities is obtained, purified and stored. Points up the importance of the Great Lakes and the Colorado River in supplying the water needs of nearby cities.

7188 "Water: The Common Necessity": 9 min., E-H
Explains the water cycle and lists ways that water is essential to life. Raises the problem of conservation of this natural resource and points out little known information about the uses of water.

5896 "The Ways of Water": 12 min., E-H
A study of the water cycle as observed in the Olympic Peninsula in Washington State.

6649 "The Wet Look": 15 min., E-H C A
Explores how Landsat's remote sensing capabilities help resolve water resource problems. The satellite provides information to hydrologists about snowfall in the mountains, enabling them to estimate the basic water supply available to western states. Landsat helps in controlling floods, both by monitoring flood plains, and by mapping snow packs and potentially dangerous artificial lakes.

POLLUTION

5669 "Child's garden of Pollution": 12 min., E-H
Shows, through a child's eyes, how we use and misuse the environment, how we live with it, and how we may die with it. Shows haw various forms of pollution have transformed the environment.

No number assigned yet "The Killing Ground": Approximately 1 hour E-H C A.
Film was an ABC special presentation on pollution of both running and ground water supplies from the dumping of toxic chemicals.

No number assigned yet "Troubled Waters": Approximately 25 min E-H C A.
Film presents an insight into the effects of industrial pollution on both fresh and salt water resources.

Video Tapes

The following video tapes are available from the Office of Instructional Services, Technical Assistance Center. Consult the TAC Guidelines and Video Holdings List for further information.

"Hawaii: Kona Storms": 19:12 min., BW (Science Hawaii)
A review of tradewinds properties and cloud formation. Lesson identifies the inversion layer and explains the effect of seasonal changes and the convergence that leads to storms.

"Hawaii: Mauka Showers": 19:40 min., BW
A review of tradewind properties. Discussion of cloud formation over Oahu and the outer islands by Saul Price, Regional Climatologist of the U. S. Weather Bureau.

"Hawaiian Waters": 28:30 min., Color
Beautiful illustration of Hawaiian fresh waters. Describes the advantages of Hawaiian streams as good habitat for different kinds of fishes, shrimps, and various inhabitants of fresh waters.

"The Wet Look"; 15:00 min., Color
Explores how Landsat's remote sensing capabilities help resolve water resource problems. The satellite provides information to hydrologists about snowfall in the mountains, enabling them to estimate the basic water supply available to western states. Landsat helps in controlling floods, both by monitoring flood plains, and by mapping snow packs and potentially dangerous artificial lakes.

"Water: "Man's Greatest Need": 60:00 min, Color
Analysis of our water system on Oahu, historical conservation efforts and use of water. A in-depth look at the present and future water shortage. Presents a good history of water usage from the arrival of Capt. Cook to the present day.

Other Audiovisual Material

The following AV material is available from the Office of Instructional Services, Technical Assistance Center.

Super 8 mm Filmloops

372.357 "Water", Super 8 mm, 4:00 min., silent E/S
W

363.61 "Water Supply", Super 8 mm, 11:00 min., sound E
W

MULTIMEDIA KITS

581 "Fresh-Water Plants and Animals", 6 filmstrips, 6 cassettes, guide E/I
F

301.3 "Pollution", 6 filmstrips, color, 6 cassettes; 1 guide E
P

372.35 "Saving Our Planet", 2 filmstrips, color, 2 cassettes, 4 guides E
S

614.77 "Water Pollution", 2 filmstrips, 2 cassettes, guide, E/I
W

TRANSPARENCIES

553.7 "Water We Use", 22 animated Transparencies, color, guide E
W

FILMSTRIPS

550 "Earth's Resources Series: Fresh Water Resources", filmstrip, color, 45 frames, E/I
E

ABBREVIATIONS

Mathematics	M	Science Curriculum Improvement Study	SCIS
Physical Education	PE	Space, Time, Energy and Matter	STEM
Science	Sc	Ginn Science Program	GINN
Health	H	Foundation Approaches in Science Teaching	FAST
Social Studies	SS		
Language Arts	LA	Modular Approach to the Process of Science	MAPS
Student Activities	Student Act		
Nutrition	N	National Environmental Education Development	NEED
Hawaiian Studies	HS		
Career Education	C		
Value Education	V		
Library Skills	LS		